MICHIGAN STATE NORMAL COLLEGE
TRAINING SCHOOL DEPARTMENT

VOLUME III September, 1912 Number 7

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

GRADED MENTAL TESTS.[1]

PART I. ATTENTION, PERCEPTION, COMPREHENSION AND MEMORY.[2]

CARRIE RANSOM SQUIRE, PH.D.,
Chicago, Illinois.

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[1]I wish to acknowledge my indebtedness to Professors Angell, Dearborn and Judd for many valuable suggestions and for the privilege of giving these tests, and to Professor Whipple for assistance in preparing the results for publication. I am also indebted to the supervisors and teachers of the School of Education, who so kindly co-operated in arranging for the conduct of the tests.

[2][This paper will be continued in the October and concluded in the November issue.—EDITORS.]

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Summary.

Certain defects in the Binet-Simon tests are pointed out and the attempt is made to develop a more satisfactory series of diagnostic tests. To determine age-norms of mental devlopment the series of tests indicated in the above outline are applied to eight groups of ten children each, pupils aged six to thirteen years in the School of Education, University of Chicago, so selected that chronological, physiological, pedagogical and psychological ages shall correspond so far as possible. In the last six groups, however, one or more pupils are found who are pedagogically retarded by one or two years. The results are tabulated separately for the retarded and the unretarded pupils. A decided parallelism is discovered between the experimental results and the mental development and school performance of the pupils. The final summary shows the norms of performance for unretarded pupils for each test at each age from six to thirteen.

Introduction.

How is the pupil to be classified? This is the problem which presents itself in varied and vexatious forms to the elementary school teacher. The mental measuring rod universally applied has been the amount assimilated of the knowledge specified in the school curriculum. There are accordingly as many measuring rods as there are courses of study. Whether conscious or not of the fallibility of this unit of measure or of the injustice of its universal application, the teacher has still been obliged to apply it, modified—if she is wise—by her own common sense and intuitive judgment of the child's ability, since no other standard was at hand. The effects of this

confusion of standards are patent. Miss Schmidt, from her study of retardation,[3] concludes that what we have been calling retardation is not retardation, properly speaking, but the result of a course of study unsuited to the powers of the children who pursue it. "To say that more than half of our children are backward is certainly to make an anomalous statement." The application of these same faulty and diverse courses of study as tests of the child's mental capacity has greatly aggravated the evil.

The desirability of an accepted mental scale for the grades has long been granted. Kirkpatrick[4] in 1900 called attention to the great need of mental tests adapted to the grades. Naturally, mental tests were first elaborated for the adult who had reached a state of comparative mental equilibrium. The difficulty of the problem is greatly increased when one attempts to adapt the tests so that they shall accurately measure the mental capacity of the child at each stage of his development.

Is the presumption that age-norms of mental capacity can be established with a fair degree of precision well founded? Wallin's answer to the question[5] is fair and also conservative. He says: "Just as native capacity differs with individuals, so will the capacity to acquire differ with individuals; but there is probably a certain rate of acquisition which is fairly normal in a given order of civilization, so that it is possible to establish norms which hold for the great mass of average or typical individuals."

The Binet-Simon tests of 1905, followed by the 1908 series and the more meager De Sanctis tests, were the first attempts to establish mental age-norms for the entire elementary school period. As a matter of fact, these tests were devised in the interest of the subnormal child, although based upon the capacity of a hypothetical normal child at each year of growth. We are indebted to Goddard and to other students of the subnormal child for the wide dissemination of the Binet-Simon

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[3] CLARA SCHMITT. *Retardation Statistics of Three Chicago Schools.* Elem. Sch. Teacher, 10: 1910, 492.

[4] E. A. KIRKPATRICK. *Individual Tests of School Children.* Psych. Rev., 7: 1900, 274.

[5] J. E. W. WALLIN. *Human Efficiency.* Ped. Sem. 18, 1911, 80.

tests in this country. These tests, like those in use in the Chicago Department of Child-Study, start from the correct assumption that "age-norms of native and acquired mental capacity" can have universal validity only when we eliminate all knowledge dependent upon the arts of the school.

The Binet-Simon tests have received their full share of criticism,[6] as could be expected in the case of pioneer work. Some of the defects that have been pointed out are: (1) Certain tests are too easy and others too difficult for the grades to which they are assigned, so that the tests for some higher ages may even be easier than those for a lower. (2) The tests are not entirely independent of school training. (3) The number of tests for different ages vary. This would create difficulty if one used the corrective formula recommended by Binet and Simon. (4) The tests are not standardized. Their advocates seem to believe that flexibility and adaptability can be obtained only when the precision required in the regular laboratory experiment is disregarded. But this belief does not seem well founded, for it has been found possible, in the tests that we report herewith, to retain the precision of method required in the laboratory and at the same time to gain the flexibility necessary to a graded series. (5) The tests for the different ages are not comparable; at one age certain specific mental capacities and at another stage entirely different capacities are tested. If we agree with Galton that the capacity of man can best be measured by "sinking shafts, as it were, at a few critical points," these critical points should first be chosen and the shafts sunk at corresponding points for the different stages of development. The failure to do this seems to be the most salient weakness of the Binet-Simon tests.

What are the "critical points" at which we must sink our shafts if we are to estimate mental efficiency correctly? This is the first question to be answered if we would establish a series of age-norms. Most will agree that some of the most significant factors in the determination of mental efficiency are degree of attention, keenness of perception, ability to discriminate and assimilate—in other words, ability to compre-

[6] See particularly J. C. BELL. *Recent Literature on the Binet Tests*, this JOURNAL, 3: Feb., 1912, 101.

hend a situation—memory span, strength of associative connections (conditioning the rapidity and accuracy with which old associates may be recalled, as well as that ability to form new associates, which is commonly termed ability to learn), constructive or inventive power and, finally, judgment. These differentials of mental efficiency are very generally applied, both in the sphere of practical affairs and in the more limited field of the schools. Should it not be possible for schoolmen to agree upon a series of significant factors like these and to work out a series of age-norms that would furnish a far more accurate evidence of the child's stage of development than is obtainable from an examination of his knowledge of arithmetic, geography, etc.?

The tests described in this paper are offered as a tentative answer to this question. Having determined upon seven "critical points," it was next necessary to find adequate tests that might be applied at these particular points. The tests were chosen from a wide range; those that had been previously tried out in the laboratory were preferred if they were adapted to the requirements of a graded series. The Binet-Simon tests were suggestive; six of them were used in a more or less modified form.

While the criteria which determined the choice of tests were few in number, they debarred us from the use of many of the more familiar tests. These criteria were as follows: (1) Each test must be applicable to all stages of development. To obtain a series of mental norms—a truly genetic series—it is obviously necessary to use the same, or at least similar, tests for all the years covered by the elementary school period. Such a series of reactions should be comparable from age to age. This requirement alone ruled out many tests, since few of them are so arranged that they can be given equally well to children of six and seven years and to those of twelve and thirteen years. Most of the tests used in our laboratories are too difficult to be used with young children. (2) Each test must present a problem which the child can grasp, if not in its entirety, at least sufficiently to awaken his interest and arouse effort. (3) Each test must have content, or, lacking that, must make a sensory appeal to the subject. Much of the material

of the ordinary laboratory test is unsuited, both in form and matter, for use with immature children. Since, for the sake of analysis, the laboratory test has been reduced to its lowest terms and thereby largely divested of content, it can appeal only to the subject experienced with the psychological experiment. (4) Each test must be so arranged that it can be completed without causing undue fatigue. This criterion ruled out other laboratory tests which would have been too fatiguing to be employed with young children. (5) There should be a minimum of apparatus. The less machinery and unfamiliar apparatus, the easier it is to induce an 'at home' feeling at the beginning of the test. This is also a desideratum if the tests are to be utilized by teachers who do not have access to a psychological laboratory. No apparatus except a stopwatch was required with this series of tests. (6) The conditions of the experiment required that the complete series of tests should not comsume more than two, or at most three, school periods, and no school period was longer than thirty minutes. This requirement necessitated the shortening and simplification of many of the tests chosen. All of the tests of attention, keenness of perception, ability to size up a situation, memory span, association, constructive ability and judgment were selected or modified so that they would conform to these six requirements.

It is obvious that to obtain graded norms the children tested should be representative of their age. So far as possible the chronological, physiological, pedagogical and psychological ages differentiated by Wallin[7] should correspond. I was particularly fortunate in my opportunities in this regard. The subjects were children from the School of Education at the University of Chicago. These children are given a very careful physical examination at the beginning of each year. Thus there exists at the service of the experimenter a complete physical record for each child during the years he has been in attendance at the school. Then, too, the promotion and grading is more carefully supervised than in the ordinary school. It seems fair to presume that when physical, pedagogical and

[7] J. E. W. WALLIN. *Clinical Psychology and the Psycho-Clinicist*, this JOURNAL, 2: 1911, 198.

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chronological ages correspond the psychological age may also be in agreement. The school life of these children is as healthful and normal as it is possible for school life to be.

Ten children were selected for each year. In order to restrict the distribution of ages within each year, I selected only those who had had a birthday within six months. Thus, the ages of all children in the six-year group fell somewhere between six years and six years six months.

The majority of the six-year-old children came from the lower first grade, the seven-year old from the second, the eight-year old from the third, the nine-year old from the fourth, the ten-year old from the fifth, the eleven-year old from the fifth and the sixth, the twelve-year old from the upper sixth and the seventh and the thirteen-year old from the upper seventh and eighth grades. Each group of ten above the second year contains a few who are slightly retarded or who have some physical defect which has hampered them in their school work as well as in the tests. The number of retarded pupils in the several age-groups is as follows: 8th year, 2; 9th year, 2; 10th year, 1; 11th year, 5; 12th year, 4; 13th year, 3. The results from these retarded children were tabulated separately. None of those marked retarded was more than two years, and most of them were not more than one year behind their grades.

The careful correlation of physical, pedagogical and chronological ages and the separation of the records for those who do not show this correspondence ought to ensure a standard achievement for the unretarded class. These records, then, may be safely taken as *norms* for the respective ages.

The tests were all given individually. While this consumes more time than group testing, it is the only method which gives every individual an equal opportunity. Individual testing is essential to reliability of results in working with children. The experimenter and the child come into close *rapport;* questions can be adapted to the comprehension of the individual child, and the exercise can partake of the nature of a pleasant game rather than of a test, as is requisite to a good working mood in a child. All this is manifestly impossible when the tests are given to a group. While standard conditions were maintained throughout the series, it was also deemed essential that the

tests be adapted to each age and individual in order to secure the most effective reaction; *e. g.*, with the six-year old group the responses to most of the tests were oral, and records were made by the examiner, but in those cases where the time-factor was not used as a determinant, the responses of the older children were written by the children themselves.

The Tests.

1. Attention: The test for degree of attention which seemed best adapted to our purpose was the modification of the "a-test" used by the Chicago Department of Child-Study.[8] At the top of the page are printed 100 a's, distributed evenly in rows. Below there are 100 a's, distributed among one hundred nonsense syllables. This modification of the test enables the experimenter roughly to abstract the motor time—the time required to mark out the 100 a's—from the finding or perception time—the extra time required to mark out the a's when distributed among the one hundred words. We added a third set of a's identically the same as the second, but introduced the element of distraction by reading to the pupil during the time he was marking out the a's. He was expected to give the substance of the matter read after the completion of his test.

This test gives two measures of degree of attention: (1) Accuracy with which all a's in sets two and three are marked out; (2) the greater length of time required for the third series in which the element of distraction was added.

As the table shows, the second measure was somewhat ambiguous, for in several cases, on account of the counter-effect of practice, the time required for the third series was even shorter than for the second. Had we used a different distribution of a's for the third set, the effect of practice would not have counteracted the effect of distraction. The first measure, that of accuracy, proved more reliable. The errors made were all omissions.

The irregularity of results for the retarded groups is in marked contrast with the regularity found in records of the unretarded; but in determining norms of accomplishment we

[8] D. P. Macmillan and F. G. Bruner. *A Special Report of the Department of Child Study and Pedagogic Investigation.* Chicago, 1906, pp. 49-57.

are concerned only with the results from the unretarded cases. These cases present a clear record of development in degree of attention with growth in years, whether we consider the average number of errors made or the maximum of error. This

TABLE I.

Degree of Attention Measured by Number of Omissions.
Unretarded.

Group Age.	Series II. Av. No. Errors.	Max.	Min.	M. V.	Series III. Av. No. Errors.	Max.	Min.	M. V.
6	5.5	10	1	2.2	3.4	10	0	2.5
7	4.5	11	0	3.3	3.5	8	1	2.2
8	2.1	4	0	1.1	1.5	4	0	1.0
9	2.2	5	0	1.2	3.0	8	0	1.6
10	2.0	5	0	1.7	2.5	8	0	2.3
11	2.3	4	0	1.5	3.6	9	1	3.5
12	0.25	1	0	0.27	0.5	2	0	0.75
13	0.6	2	0	0.7	0.5	2	0	0.6

Retarded.

Group Age.	Series II. Av. No. Errors.	Max.	Series III. Av. No. Errors.	Max.	
8	3.0	6	2.5	3	2 cases
9	12.6	15	16.5	17	2 cases
10	3.0	3	6.0	6	1 case
11	9.6	14	6.9	41*	5 cases
12	3.7	6	1.7	3	4 cases
13	6.0	10	6.3	12	3 cases

Degree of Attention Measured by Lengthened Time with Distraction.

Group Age.	Unretarded Av. in seconds.	Retarded Av. in seconds.
6	22.9	....
7	25.9	....
8	6.5	21.
9	—6.2	5.
10	13.6	—16.
11	14.0	11.
12	2.0	18.
13	—16.0	—5.

*The large number of errors made in the third series with distraction by the retarded child of the eleventh group is not surprising to one familiar with the child, who was characterized by all who know him as a "day dreamer and very flighty."

table shows two decided breaks in the rate of progress which correspond very closely to our customary division of the elementary school period. These breaks occur between the seventh and eighth years, and again between the eleventh and twelfth; they mark the transition between the fluctuating atten-

tion of the primary grades, or sixth and seventh years, and the more sustained attention of the four years belonging to the intermediate period and again between this period and that of the grammar grades, or twelfth and thirteenth years, where the attention is under excellent control.

2. Perception: The a-test as used by the Chicago Department of Child-Study and Pedagogic Investigation[9] affords one of the best measures for determining the correspondence between the rate of perception and age. Perception-time was found by subtracting the motor-time from the total time taken to mark out a's in the second series. In order to allow for error arising from undue shortening of perception-time in the case of many omissions, I have followed the practice of the Department of Child-Study, and in reckoning the length of perception-time have added to the actual time taken the amount of time it would have taken to mark out the a's which were omitted; *i. e.,* perception is made comparable with motor-time on the basis of a perfect record.

The time-factor is not as satisfactory a unit in the determination of efficiency as is quality of the work done. Some of the strongest students tested had a slow reaction time, and others, who ranked low in the construction and judgment tests, surpassed them in rapidity of reaction. There is, however, a fair degree of correspondence between perception-time and age. The gain made in the eighth over the seventh and in the twelfth over the eleventh year is again noticeable.

TABLE II.

Perception-time in Seconds.

	Unretarded.					Retarded.				
Group Age.	Av. Motor Time.	M. V.	Av. Motor Perception.	M. V.	Av. Perception-time.	Av. Motor Time.	M. V.	Av. Motor Perception.	M. V.	Av. Perception-time.
6	219.5	33.9	393.6	75	174.1	.....	....	.....	....	....
7	144.1	28.7	226.4	43.9	82.3	.....	....	.....	....	....
8	99.	9.2	155.5	28.4	56.6	106.5	3.5	176.5	3.5	70.
9	107.5	16.1	159.3	16.6	51.8	120.	26.6	193.3	42.9	73.3
10	81.	9.8	140.	23.	59	130	....	180.	....	50.
11	82.6	6.2	150.	20.	67 4	82.6	9.1	141.2	12.5	58.6
12	81.	10.6	118.2	13.7	37 2	81.	13.	120.5	10.7	49.5
13	76.	6.5	126.5	8.5	50.5	83.3	16.9	136.	31.3	52.7

[9] MACMILLAN AND BRUNER. Op. cit.

The results (Table II) show a longer perception-time than that taken by the normal cases reported by the Department of Child-Study. This is perhaps due to a difference of emphasis; they may have laid stress upon speed, while we made the marking of a's the dominant requirement.

3. Comprehension (ability to comprehend a situation): The possibilities of studying mental growth are greatly enlarged if we use material rich in content and meaning in place of the discrete and—from the child's standpoint—uninteresting matter presented in the a-test. The material selected must not be too complicated to be comprehended by a six-year-old child, and must be deemed worthy of study by the oldest group. I chose for this test five pictures, all reproductions of paintings by artists of note. The first three were colored, and the last two were in black and white. The pictures in the order in which they were given were: *In Disgrace,* by Sigsbeekar—a pouting child sits with face to a corner, while a dog, the picture of dejection, crouches beside her; *In Summer,* by Van der Veer—six Dutch maidens sit in a circle on the grass, knitting; the landscape is typically Dutch; *Children of the Press,* by Thompson—poorly-clad children are shown in a crowded city street on a winter's day in the act of receiving their papers for the day's distribution; *The Goose Girl,* by Millet—too well known to need description; and lastly, *Embers,* by Eastman Johnson—an old man seated before a grate in which the fire is slowly dying.

The test was given in two forms: The first form required appropriate titles for each picture; the second, the formulation of pertinent questions. The first form gives an opportuntiy to study the development of interpretation and assimilation, the ability to unify discrete perceptions and to find meaning; the second tests the same capacity by an obverse method.

A. Ability to supply titles. It goes without saying that we did not ask the younger groups for the titles of the pictures. We asked them what they would like to call the picture. There was no time limit in this test. The children were given one picture at a time, in the order mentioned, and were allowed to study it until they found a name which suited them. The titles given varied from the mere enumeration of the objects

in the picture to appropriate phrases that displayed a complete apprehension of the artist's meaning. We have subsumed these titles under five rubrics: enumeration of objects, description of picture, unification in terms of action of principal figures, superficial unification in terms of relation to principal object and complete comprehension evidencing imaginative insight. "The lonely man," one of the titles given to *Embers,* illustrates what we mean by superficial unification; there is a partial comprehension of meaning, but a failure to see the significance of the dying fire pictured in conjunction with the old man. A very few in the twelfth and thirteenth group did comprehend the complete meaning, as titles like "The End" would indicate. "The Punishment," a title given several times for the first picture, shows complete comprehension of its meaning. The significance of this picture was grasped earlier and more frequently than that of any other.

With only ten children in each group and five rubrics it seemed unwise to distribute the results further by separate tabulations for unretarded and retarded. Had it seemed advisable to do this, the results would not have presented as many irregularities as appear in Table III.

TABLE III.

Comprehension as Measured by Ability to Supply Titles.

Group Age.	Enumeration of Objects. Per Cent.	Description. Per Cent.	Action. Per Cent.	In Relation to Principal Object. Per Cent.	Complete Comprehension. Per Cent.
6	62	28	10	..	..
7	20	70	10	..	..
8*	16	28	40	12	..
9	8	42	28	20	2**
10	..	24	46	26	4**
11	6	10	38	36	10**
12	4	12	14	52	18
13	..	6	30	30	34

*Four per cent. of this group failed to give a title.

**These first instances of complete comprehension were interpretations of the meaning of the first picture. The artist has succeeded in expressing himself so clearly and forcefully upon a well known theme that even the younger groups succeeded in grasping the whole situation.

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From these results it seems fair to say that: (1) No six-year-old child can be expected completely to comprehend a situation presented pictorially. (2) Neither can a seven-year-old child be expected to give an adequate title—a child of this age seems most interested in the appearance of the objects presented. (3) The eight-year-old children are inclined to interpret meaning in terms of action, and a few are able to give superficial titles. (4) In the ninth and tenth years, while descriptive phases and activities of the objects are most likely to be considered, there is, in case of the first picture, complete comprehension of the artist's meaning. The descriptive titles, when given, are condensed into terse phrases, and no longer stretched out into disjointed sentences. (5) In the eleventh year the answers show a wide distribution, due mainly to the fact that the proportion of retarded pupils was greater in this year than any other (the table has not differentiated the retarded from the unretarded). This fact accounts for a small percentage of cases in both the eleventh and twelfth year that indicate only initial stages in comprehension of meaning. (6) In the twelfth year the majority of names given to the pictures would pass for titles, although a large proportion of them deal with superficial aspects. (7) There were many cases of complete comprehension in the thirteenth year. This imaginative insight could not be expected before adolescence.

B. Ability to question. To formulate in a pertinent question the main thought of a picture is more difficult than to find an appropriate title for it. There were numerous failures to frame any kind of a question. The questions asked have been classified as irrelevant when extraneous and irrelevant associations were called up, as minor when unimportant aspects of the picture were dwelt upon, and as essential when the main thought of the picture was indicated. The questions on essential features asked in the cases of the seventh and eighth-year groups were all with reference to *In Disgrace.*

Comprehension as Measured by Ability to Formulate Questions.

TABLE IV.

Group Age.	Failure. %	Irrelevant. %	Minor. %	Essential. %
6	50	40	10	0
7	30	32	32	6
8	12	13	68	7
9	..	48	40	12
10	..	20	56	24
11	..	16	60	24
12	..	22	48	30
13	..	8	54	58

We note that in the sixth year there are many failures to frame questions, and that at best questions are likely to be irrelevant. In the seventh, and still more in the eighth year, the child's questions are relevant, but deal with minor aspects of the picture. There appears to be a fairly steady growth in the ability to frame essential questions through the remaining years.

I have selected a few questions from those asked regarding *Children of the Press* and *Embers* as illustrative of the growth with age in ability to comprehend meaning and formulate fitting questions. "What is that writing?" (The name of the artist) was asked by a six-year child. "Are the children going to school?" was asked by a seven-year old. Neither child had the slightest comprehension of the meaning of the picture before him and both questions were classed as 'irrelevant.' "What papers are they selling?" and "Is there a fire in the fireplace?" were asked by children in the eighth year. These questions are also typical of those which were classed as 'minor,' since they indicate only a superficial grasp of the artist's meaning. "Why do the children sell papers? Is it to make money for their parents?" and again "Is the old man thinking of his family who are gone and is he about ready to die?" were asked by a child of twelve and one of thirteen years. Questions which showed the fairly complete comprehension of meaning illustrated in these two examples were always classed as 'essential.'

4. *Memory:* Does memory develop during the elementary school period *pari passu* with mind? Investigators are not in complete accord. Allowances must be made for differences in method and material used, which would undoubtedly account for the many differences in result. The test with digits employed by Smedley has the advantage that it may be given in many ways, but it presents a serious disadvantage for six-year-old children, and even for an occasional normal seven-year-old child who may not have been to school. Familiarity with digits is gained very largely in the schoolroom. Several of the six-year-old children had difficulty with the six digits

we employed in our learning test. Neither would the digits seem worth remembering to children unless they could look upon the test as a game. A maximum of effort is gained only by interest, and we cannot measure the child's actual ability unless we can obtain sustained effort on his part. The material used by Binet in his tests seems best adapted to secure correct measures of development of memory.

I used two forms of material—pictures and sentences.

A. Pictures: The Binet method was varied in the following manner: Only one card was used, instead of a series of cards. This card measured 8 by 5½ inches. Upon it were arranged twenty pictures of unrelated objects, namely, a girl's head, a hen, a barking dog, a spool of thread, a feather, an automobile, a hammer, a Morris chair, a boy on a sled, a cow, a house, a hand, a pony cart, two camels, a bottle, a slipper, a shoe, a pan, a basket of puppies and a thimble. If I had presented only ten, or even fifteen, objects on the card, I should not have exceeded the memory span of some of my subjects.

The card was exposed for thirty seconds, then withdrawn, while the children were asked to give the names of as many of the objects as they could recall. The exposure gave them ample time to glance over the entire card. The interest felt in the experiment was evinced by the frequent request to see the card again, in order to find out what had been forgotten. There was greater effort on the part of the children than could possibly have been obtained had we used digits, letters or nonsense-syllables.

TABLE V.

Memory Span as Measured by the Picture-Test.

	Unretarded.				*Retarded.*		
Group Age.	Av. No. Correct.	Max.	Min.	M. V.	Av. Correct.	Max.	Min.
6	5.3	7	3	1.2	....	....	..
7	6.5	12	5	1.3	....	....	..
8	9.5	13	6	1.6	5.0	8	2
9	9.8	15	6	2.5	8.2	11	5
10	9.1	12	6	1.9	6.0	....	..
11	11.4	15	8	1.9	6.0	7	5
12	10.5	13	8	1.7	10.6	14	9
13	10.0	12	8	1.2	10.0	11	9

Here, as in the previous tests, the results reveal at a glance three well-marked stages. Children of six and seven do not seem able to retain much more than six objects, though occasionally a child will recall more. The average number retained by children of eight, nine and ten years seems to fall between nine and ten objects, though the exceptional child may recall as many as fifteen. As a matter of fact, the table does not show the gain of the ten-year over the nine-year group—four of the latter group came within one of the maximal record. The lower average for the tenth year is to be accounted for by the lack of any exceptionally good record like that made by one of the nine-year group. In the memory test the eleven-year group grades with the twelfth and thirteenth, instead of with the younger groups, as in the previous tests.

B. Sentences: Auditory memory was tested by the Binet method as modified by Whipple[10]. These sentences are arranged in a progressive series, beginning with two and ending with forty-two syllables. They have the same advantage that the pictures possessed over the material ordinarily employed in laboratories. We began with the second sentence for the six-year group; but with the older groups it was found to be economical of time to begin with the fourth or fifth sentence, since these were well beyond the range of possible error. Each sentence was given but once, slowly and distinctly, and the child was asked to reproduce it. During this test the child was always directed to sit with his back turned toward the experimenter.

The exclusion of the retarded group has brought out a very close correlation between mental growth and immediate memory. The substitution of a word, even though it did not distort the meaning of the sentence, a single insertion or omission, was counted an error. The figures, therefore, represent the number of sentences correctly reproduced. The number of syllables correctly reproduced can be roughly estimated by multiplying the number of sentences by two, though this rule will not hold entirely, especially for the longer records.

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[10]G. M. WHIPPLE. *Manual of Mental and Physical Tests*, Baltimore, 1910, p. 494.

TABLE VI.

Memory Span as Measured by Sentences.

Group Age.	*Unretarded.* Av. No. Without Error.	Max.	Min.	M. V.	*Retarded.* Av. No. Without Error.	Max.	Min.
6	7.8	10	6	0.8	....	....	..
7	8.4	10	6	1.0	....	....	..
8	9.8	11	8	1.0	8.0	8	8
9	10.1	13	8	1.4	9.0	9	9
10	10.9	14	9	1.2	6.0	6	6
11	10.9	13	10	1.2	9.5	12	8
12	13.5	16	11	1.5	10.5	12	9
13	14.5	16	12	1.5	10.6	13	8

Exceptions are due mainly to unevenness in two points of the series. The twelfth and seventeenth sentences are not as difficult as those immediately preceeding them, even though these sentences contain two more syllables than the eleventh and sixteenth. The twelfth and seventeenth sentences could easily be modified so that the series would be one of progressive difficulty. The twelfth sentence was found less difficult than the eleventh because of its simpler form, possessing fewer modifying words. The simplicity and familiarity of the idea presented by the seventeenth makes it range in difficulty with the eleventh and twelfth. Table VII shows the relative ease of the sentences.

TABLE VII.

Relative Ease of Sentences Used for Testing Memory.

Percentage correctly reproduced.

Sentence Age.	7th. Per Cent.	8th. Per Cent.	9th. Per Cent.	10th Per Cent.	11th. Per Cent.	12th. Per Cent.	13th. Per Cent.	14th. Per Cent.	15th. Per Cent.	16th. Per Cent.	17th. Per Cent.
6	60	50	40	0	0	30	0	0	..	..	..
7	90	70	30	20	0	30	0	10	..	..	..
8	90	100	50	40	0	40	10	10	..	..	..
9	90	90	90	50	20	60	0	10	..	..	..
10	100	100	80	70	20	30	40	20	..	..	..
11	100	70	50	40	10	70	40	20	..	..	..
12	100	90	70	100	30	70	50	50	10	10	50
13	100	100	90	80	10	70	70	50	30	30	70

There were so many complete failures on the fifteenth and sixteenth sentences that I did not try the seventeenth until the

twelfth year. But the results indicate that the seventeenth sentence is certainly no more difficult than the thirteenth or fourteenth. As previously stated, the errors were mainly cases of substitution, insertion and omission that did not destroy the meaning of the sentence. After the sixth year the ideas were correctly reproduced until the fifteenth and sixteenth sentences were reached.

(Continued in the October number.)

A STUDY IN THE PSYCHOLOGY OF SPELLING.

LINUS W. KLINE

State Normal School, Duluth, Minn.

SUMMARY.

The ability to spell is based on an acquired sensori-motor arc. The rate at which the arc is formed bears a significant relation to the relative uses made of the dominant and subdominant imaginal types during the conscious stages of the process. The sensory section of the arc forms more slowly and is more readily disturbed by changed conditions than that of the motor. An individual may have several spelling arcs each commanding its own type of imagery and serving its own group of words.

INTRODUCTION.

In so far as spelling depends upon habit-forming processes, it is an act of skill and, as such, involves a sensori-motor mechanism. Three facts, however, complicate what would otherwise be a simple response: the first is the tendency toward special imaginal types, the second is the two possible modes of expression, oral and graphic, and the third is the non-phonetic character of our language. The relations existing between the first two groups of facts give rise to the following spelling arcs:—the visual-graph-motor, visual-speech-motor, auditory-graph-motor, auditory-speech-motor, and also combinations of these simple arcs. The present investigation was undertaken (1) to seek further verification of the relations between the imaginal types, modes of presentation and of expression as related to the spelling process; (2) to see if any significant connections exist between the imaginal types, possible aids, kinds of errors and hindrances, and (3) to study the nature of the existence of imaginal types, indirectly, of course, and their mutual relations.

General Plan of Work.

The general plan of the work is indicated in detail in Table I. The fourteen subjects were high-school graduates in their third term at a state normal school. Eight worked under favorable and six under unfavorable conditions, as related to their inferred imaginal types, while two of the imaginal "favored" and three of the imaginal "unfavored" worked under conditions that interfered with the *motor* phase of their spelling arcs. C. C., E. S., E. P. and G. R. preferred the graph-motor form of expression, but under the conditions used only speech-motor, while K. K. was speech-motor, but had to use graph-motor. The imaginal types and spelling-arcs were determined a month before the spelling investigation began. Some seven weeks were devoted to this preliminary work. The methods used are detailed at some length on account of the vital relation existing between the nature of the imaginal types and the results of the spelling tests.

Preliminary Tests of Imaginal Types.

These determinations were made by four methods: The subject (*a*) wrote as rapidly as possible for five minutes (five minutes were allowed but not always used) (1) the names of objects characterized by color, (2) the names of objects characterized by sound; (*b*) memorized a 25-member letter-square and reproduced it line by line, diagonally, as a cross, spirally, and by any horizontal or vertical line as called for; (*c*) memorized letter-squares, letter-series, and nonsense figures (4, pp. 396-399) (1) without directions, (2) with directions; and (*d*) described the usual and preferred methods of learning and reproducing the several school subjects.

The lists of words in "*a*" were each distributed into the following classes: pure visual, pure auditory, visual auditory, mixed, perceptions (words suggested by objects in the room or by accidental disturbances), and associations (words of doubtful imagery whose presence was apparently due to a strong bond of association).

C. R.'s visual and auditory lists, respectively, are given as examples. *Visual:* Sunset, sky, lake, trees, river, wine, grapes, oranges, apples, chocolate, eyes, hair, dress, canary, robin, rose, lily, daffodil, carnation, violet, tril-

lium, evergreen, class-colors, grass, pumpkins, carrots, smoke, lightning, blaze, snow, scarlet, fever, diphtheria. Total 33.

Auditory: Thunder, buzzing, bell, fog-horn, waves, mouth-organ, wind, storm, trolley-car, program-clock, dinner-hour-at-hall, yelling, class-day, laughing, crying, mewing, cackling, scolding, saw-mill, train-wheel, screeching, creaking, whistle, drum, flute, picnic, small boy, slate pencil, squeaking, chirping. Total 30.

Concerning this latter list, the subject says: "I tried to think of as many different kinds of sounds as possible and *then give names to them.* In some instances the visual image came before the auditory. I saw several people seated on the ground at a picnic before I heard them. I saw the saw-mill before I heard it. Some of the words suggested noises and pictures just as the remembrance of a song may recall a singer and yet not be associated with her."

A critical analysis of the list gave the following results:—

Visual List.		*Auditory List.*	
Class.	*Percentage.*	*Class.*	*Percentage.*
Visual	76	Auditory	40
Visual-Auditory	0	Auditory-Visual	26
Mixed	0	Mixed	20
Perception	0	Perception	0
Association	24	Association	13

At the end of the five minutes the subject was asked to state whether the time seemed relatively long or short. Test "*a*" while being performed was considered a mere "feeler," but it tallied so well with the more rigid determinations that more than passing mention seemed justifiable.

The results from the "*b*" tests were, in themselves, of little value, for it usually happened that the subjects who could reproduce the letters correctly and readily in one way could do so with equal readiness in any other, which according to theory and previous investigation should be true only of visiles. But it turned out that the manner of learning correlated with the type of imagery later determined. The audiles and mixed types made use of mnemonic devices and rhythmic combinations, while the visiles relied more on repetition, place-memory and the use of the initial letters in the top and in the vertical left lines as cues.

The material for test "*c*" (1) *without direction* consisted of four 12-letter squares, four 9-letter or digit series and 4 nonsense figures for graphic reproduction. After the letter-square had been recorded, both the manner of learning and recall were given at once in detail.

A few cases taken at random are submitted.

Letter Square.

Original.	Reproduced.
V B J T	B K Z
Z R F Q	Z R J Q
K D G H	K D G H

C. C. (audile) writes in her introspection: "B Z K were purely auditory and B was accented (the subject is ignorant of the nature and number of her mistakes). Z and R were auditory, Z being accented, J Q were visual until I was ready to write the letters, when they suddenly became the initials of James Quinn (auditory). K D G H were rhythmic to me, until I wrote them down when they suddenly meant Kid Gladys Hawkinson."

C. R. (mixed) writes of the same card: "I learned this square by imagining I heard the letters said and by visualizing their positions. In reproducing them, I began writing under a strain and when I came to the last line I could not see the first two letters, and as I had no time to ponder, I wrote G H, which I saw clearly and remembered some peculiarity about them."

K. K. (decidedly audile) writes concerning the same square: "I accented the end letters to the right. I failed to recall the first line, but the other two I seemed to hear whispered to me as I wrote them."

Learning and reproducing the 9-letter or digit series showed wide differences in both quality and quantity of work. Two general tendencies emerged at once and persisted throughout: (1) that of quality of work as to accuracy of order, few substitutions, taking advantage of end-letters in the series, and small quantity of reproductions; (2) that of a relatively large reproduction, poor in quality as to inversions, substitutions, and a tendency to euphonious combinations.

A. G. (visile) says: "In the first series (original, J B R F C M N P V, and reproduced as J B R F P W C M V) the first four were associated with two words, Job and reference; the second four, P W C M, were visualized in their order as the *second four* of the series and the last letter was distinctly seen as the end letter."

K. K. (original series W Q C J M X B Z K, and reproduced as W Q C X M J B Z K) says: "W Q was reproduced by position, C M X were auditory, through the peculiarities of the sound of the three letters 'saxom.' The next four were auditory and were grouped into a word sounding like 'jay-be-z-ke.'"

E. P. (mixed type) (original series K B S M C Z P F R, reproduced K G C Z F C M) says: "K G were visual because I remembered Kg to denote kilogram in physics. C Z were auditory on account of their sibilant sound. F C were visual as the initials of a name. M was auditory on account of its humming."

Learning and reproducing the nonsense figures, graphically, gave unexpected values. The *procedure* required *S* to close her eyes and hold the pencil as in writing, while *E* laid the drawing on the table and drew *S's* hand over the lines twice. The movement was slow and continuous and the pencil was not raised from the paper until the tracing was completed. *S* was then given a sheet of paper and with closed eyes reproduced the figure as she thought it was. *S* knew that the figure had but six lines and five angles. An arbitrary value of 50 was assigned to the lines and angles respectively, and thus permitted a quantitative determination of the reproduction in

terms of the original figure. While the test aimed directly to discover the role of motor imagery, it gave, indirectly, valuable evidence on the condition of other forms of imagery. Results were not uniform in accuracy for the same individual; a very good reproduction might be followed by a poor one, but when this occurred, the subject *could tell why.* In the light of preceding and subsequent tests, it showed that if a visile failed, it was due either to a poor motor image not supplemented by a visual image or to the absence of both, but in the case an audile failed, it was for the lack of motor imagery alone.

K. K. speaks of making synchronous movements with the left hand. M. P. (an audile) says: "I noticed that my body swayed in unison with the hand movements." Visiles and audiles used verbal motor imagery in describing the figure while tracing it, *e. g.,* down, up, back, out, oblique, etc. Visiles and mixed speak of rolling the eyes and of strain in the eyelids (balls) and in the outer portions of the eye globe. The percentage of accuracy of the visiles was from 20 to 45 per cent. higher than that of the audiles.

The second part of "*c*" test, given *with direction,* adhered strictly to the conditions outlined by Titchener (4, p. 389), but in addition to the letter-squares, series and nonsense-figures, 12 series of short difficult words in groups of three each were presented, after the manner of the letter-squares and series. The results of the "*c*" tests not only contributed material evidence to the problem of imaginal types, but it aided in determining the subject's spelling arc (see Table 1).

The "*d*" tests, if they may be considered tests, prevented a too narrow interpretation of the more exact methods and gave presumptive evidence of the existence of "preferred" and mixed imagery as against isolated and "boxed up" imaginal types.

E. S. (audile) writes concerning her ways of learning and reciting the school subjects: "I find that I have to read my lessons aloud before they mean much to me. In studying Latin I never can recite unless I have heard myself say the words at least once. But no matter what I study, I always know almost the exact place in the book, the side of the page, the distance from the top or bottom at which the subject-matter is placed. I do not see the subject-matter, nor hear it, nor can I always recite on that part, but if it is mentioned, I know where it is. In studying history I read the lesson aloud

and get a picture, not of the words, but of the scene mentioned. Sometimes it is not convenient to read it aloud, and in that case I can still hear the sound of the words though I am not even whispering them. When I have to recite on a topic, I find that I am not very well prepared unless I have practiced reciting to myself. When I do recite, I find that I have the same voice inflection and accent and emphasize the same words as when reciting to myself. In learning poetry it is the same. In geography I have a vivid visual picture of every map I study; I visualize the products of a country as I study them. In taking lecture-notes it is very hard to understand what is being said, unless I can see the lecturer's face, and when I reproduce the words for myself I hear the voice, the words, and see the expression of the face attending every thought. When I hear a new word I can see the expression on the face and hear the voice of the speaker for a long time afterwards. I think that, while my type of imagery is mixed, auditory predominates." The results throughout the several tests gave uniform evidence that E. S.'s imagery, so far as it related to language and words, was auditory-motor.

These several determinations unite in showing that imagery may exist either as mixed or as preferred:—the former means, here, that visual, auditory and motor images function mutually together and are disadvantaged when forced to work separately in word learning, and the latter, that either visual-motor or auditory-motor is the preferred type. An analogous condition exists in the right-handed who in learning tennis, for example, prefer to practice with the right hand and would be handicapped if forced to use only the left.

Spelling Tests.

General Conditions of Work.—The subjects were divided into seven sections of two each, and the sections combined into three groups according to their imaginal types as indicated in word learning, *i. e.*, visual-motor, auditory-motor, and auditory-visual-motor. The imposed conditions of Section "c" were not so much an adverse appeal to their dominant imaginal types as they were an interference with their habitual ways of learning to spell. E. P. says: "In learning to spell audition aids me but little; I rely almost wholly on visualizing and writing." The prescribed mode of learning denied her both of these means. C. R., although strongly auditory for some things, says: "I had a desire to write the word for the picture, but before my imagined picture was formed and stable, I had to spell the word by syllables. Spelling aloud with no word before me and syllabicating took away almost everything I had gained from hearing." These considerations

seemed to justify placing Section "c" with the unfavored groups. This classification was called in question, however, by the rapid rate of learning of these two *S's*, which in turn may be due to their high average spelling ability (87.5 per cent.).

The spelling abilities of the subjects (see Table I) agree remarkably well with their school standing and general work-

TABLE I.
Showing Plan of Work.

Subject		Imaginal Types by Sections	Spelling Arc.	Spelling Ability in Per Cents.	Mode of Learning
H. B.	Fa	V-Ma	Visual-graph-motor.	81	See word exposed 5 sec. on card and write it.
A. G.	Fa	V-Ma	Visual-graph-motor.	82	
M. Ch.	Un	V-Mb	Visual-graph-motor.	81	Hear word twice, spell orally and pronounce it.
A. S.	Un	V-Mb	Visual-graph-motor.	80.5	
C. C.	Fa	A-Ma	Auditory-graph-motor.	88	Hear word twice, spell orally and pronounce it.
E. S.	Fa	A-Ma	Auditory-graph-motor.	89	
K. K.	Un	A-Mb	Auditory-speech-motor.	80.5	See word exposed 5 sec. on card and write it. (This sec. recites with V-Ma sec.).
M. P.	Un	A-Mb	Auditory-graph-motor.	86	
M. Cu.	Fa	A-V-Ma	Visual-auditory-graph-motor.	82	Hear word twice, once alone, 2nd time given in sentence by monitor to write.
A. M.	Fa	A-V-Ma	Auditory-graph-motor.	83.3	
R. W.	Fa	A-V-Mb	Visual-auditory-speech-motor.	75.5	See, hear, spell, pronounce and write word.
E. W.	Fa	A-V-Mb	Visual-speech-graph-motor.	85	
E. P.	Un	A-V-Mc	Visual-graph-motor.	83.5	Hear word twice, pronounce it, spell and syllabicate it orally and re-pronounce it.
C. R.	Un	A-V-Mc	Visual-auditory-graph-motor.	91.5	

"Fa" indicates the subjects who worked under conditions that favored their imaginal types: "Un" indicates the subjects who worked under opposite conditions. It was considered that the subjects in Sections "a" of the visiles, audiles and mixed groups respectively and also Section "b" of the latter group were learning under conditions favoring their imaginal types, while those in Section "b" of the visiles and audiles and Section "c" of the mixed group were learning under conditions unfavorable to their imaginal types.

ing efficiency, with the exception of K. K. and R. W., whose school standings range from 8 to 12 per cent. higher.

The subjects wrote a brief introspection after each test-lesson, noting whether the conditions favored or embarrassed their learning, whether the report and anticipatory processes, respectively, produced doubt or certainty, and recorded incidental aids and distractions. Separate rooms and monitors "coached" in pronunciation were assigned to oral spellers; subjects learning from visual presentation worked in the same room, but with a separate monitor. The monitors kept a record of all misspelled words, and duly labeled and preserved

LIST OF FOUR HUNDRED WORDS.

First Forty.	Second Forty.	Third Forty.	Fourth Forty.	Fifth Forty.
appall	breccia	credible	develop	empyrean
acquiesce	banana	conscience	dactyl	elixir
accommodate	bandanna	consensus	deceive	encyst
accede	bambocciade	cereal	depot	empale
assent	Barbadoes	chapeau	dahlia	enascent
acceptable	bargain	chaplain	dairying	ensemble
accessory	barnacle	cervical	daisy	enseel
assize	barratry	cleat	decennial	enterocele
allegory	basal	chagrin	decisive	ephesite
asafetida	basset	cestracion	decilitre	epithem
acanthice	bdellatomy	chlorosis	demandable	equery
abscissa	beadle	clivus	delitescence	erascible
abattoir	bedaub	chalybeate	deniance	erectile
aberrant	bedding	clinometer	denticle	Eridamus
apocalyse	begonia	cloddish	dentine	errhine
aphorism	Belgian	chaprejos	dependent	erysipelas
aphis	belladonna	chanticleer	disciple	escrow
amenable	belligerent	chartaceous	dolorous	escurial
amiable	belfry	clientele	domine	esnecy
amnios	belsire	clinant	drazel	Essene
absconce	Benjamin	Clarabella	Danish	endictment
apocalypse,	Bengalese	cleansing	Damascus	enfilade
alchemy	benzene	chalaza	Daphne	essence
anaesthesia	besom	clavicle	darkening	emollient
amnesia	Bessemer	clematis	darning	empirical
assure	betel-nut	changing	dancus	encephalic
artesian	Bethlehem	clannish	Davy	ensigncy
arson	Bedouin	clevis	decedent	eocene
abscession	bedridden	changeable	decern	epulary
absistence	bison	clemency	decidable	equable
auctioneer	bisson	ceryl	declinable	equitable
apricot	bivious	circus	delirious	erasure
aries	bizarre	cervia	demise	ericaceous
arable	blaming	citreous	demurrage	erratic
arsenal	Blenheim	chalice	depascent	erotesis
arachnoid	blenny	citrus	discind	escapable
arbuscle	bloedite	chalet	disgavel	escalop
araceous	blouse	coadjuting	domesman	escroll
appian	beryl	clysmian	druid	espionage
appreciable	Boccaccio	clepsydra	dromedary	estimable

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all of the subject's written work. The words were written in a large, legible, uniform hand on cards two by three inches, and to favor economy and increase accuracy were numbered from 1 to 400. Words unlearned during the first series could be learned, of course, only during the second, as the conditions proscribed the consultation of dictionaries and other sources. The subjects frequently recorded during the second series the recognition of words misspelled during the first.

Material.—The material consisted of obsolete, technical, unusual and odd forms of words, four hundred in number,

LIST OF FOUR HUNDRED WORDS (Continued).

Sixth Forty.	Seventh Forty.	Eighth Forty.	Ninth Forty.	Tenth Forty.
estrepe	Gabriel	holiday	invidious	loathful
estoppel	garnishee	homeopathy	invariable	litmus
eulogy	garreteer	homonymous	iridescent	militia
Eugenia	garrulous	hollyhock	Israelite	medallion
Eusebian	gabion	hospitable	isotherm	liturgic
eurycerous	garlic-pear	humerus	irascible	luscious
esteemable	gelatin	hydropathy	irritable	lunette
evanesce	gemellus	hysteria	irony	Lyonnaise
eversive	genius	Huguenot	itinerary	lythraceae
evincible	geyserite	horrify	jardiniere	mackerel
exceedable	gullible	hospice	jasmine	Maccabean
excitable	gypsy	hurdle	jaundice	Madeira
evincive	grenadine	igneous	jessamine	maintenance
excrete	gyrfalcon	iguana	jeweler	Malachi
exercisible	grimace	illicit	jocoseness	malaria
exhalable	guerrilla	imminence	judicative	marsupial
exigible	gyroscope	imperious	joinery	measles
expiring	gosling	implacable	juvenescent	Mafia
explicit	gossamer	improbable	keelson	medalist
expunge	gordiacea	incessant	khedive	onomatopoeia
exspuition	gristle	indefensible	kilostere	obliging
facetious	gaberdine	indefinite	kennel	observable
facial	guillotine	inducible	kilolitre	orguinette
facing	gargoyle	infrangible	knowable	original
fagging	Gargantua	internecine	lactiferous	osirify
falciform	gallicize	ichorous	lachrymal	osseous
fallacy	glaireous	illegible	lacing	piperitious
falsifier	gallinaceous	illative	lactescence	maxilla
fanciful	gambeson	immiscible	lieberkuhn	medusa
farrier	galvanometer	immolate	leprosy	mavis
fascicle	Ganymede	imperceptible	licorice	mediaeval
farinose	gaming	imprimis	liquefy	maelstrom
fascine	Gehenna	inaudible	lieutenancy	nullify
fatuous	germicide	inclinable	lattice	nutrient
feasible	Gethsemane	inclemency	legible	nuisance
favose	gullet	indehiscent	lemonade	remittance
febrile	herring	indelible	liaison	recision
fencible	hickory	ineffable	liege	scission
faciate	hirsute	ingratiate	linseywoolsey	seismic
ferial	hinderance	interrogate	litigious	seceder

divided into ten groups of forty words each. (See lists.) Actual words conform better to ordinary spelling conditions than nonsense syllables. (1, pp. 482-83.) A series consisted in learning the ten groups at the rate of one group per lesson, three lessons per week. A lesson consisted of two parts: (1) forty words were taught, and (2) the subject's knowledge of the forty taught in the preceding lesson was tested. By this arrangement eleven sittings were required to complete a series. The entire work required seven weeks. At the close of the second series the subjects examined each of the four hundred words and indicated whether it was a *new,* a *doubtful* or a familiar word—an essential item in determining what was actually *learned.*

Results.—Table II shows the entire number of errors made by each section in every lesson. The mistakes are grouped under three heads: (1) "error," (2) misspelling, "msp," and (3) wrong-word, "w-w." This grouping arose from the fact that the two subjects comprising a Section would not only often miss the same word, but would make more than one error in it. For example, *eurycerous* was spelled *euriserous* by one subject and *eurycirous* by the other of the same Section. As a wrong word it counted 1, as a misspelled word 2, and as to errors 4. Comment on the significance of these facts is made below. The percentages of *new* and *doubtful* words of the favored groups, A-Ma, A-V-Ma, V-Ma and A-V-Mb are, respectively, 43.10 per cent., 38.50 per cent., 41.75 per cent., 53.37 per cent., and of the unfavored, A-Mb, A-V-Mc and V-Mb, are, respectively, 46.74 per cent., 48.74 per cent. and 49.24 per cent. That is, the unfavored groups have an excess of 3.97 per cent. to their advantage.

Table III, showing percentages of correct spelling, is derived from the column of misspelled words of Table II. Graphs 1, 2 and 3 further express the facts of the same table. A comparison of the percentages of correct spelling of the Favored and Unfavored Sections of the V-M Group shows that the latter excel the former in five out of twenty lessons, and that four of these five occur in the first series. The averages of the percentages in the second series of the Favored and Unfavored sections of this Group exceed those of the first series

TABLE II.

Distribution of Spelling Mistakes by Lessons and by Sections.

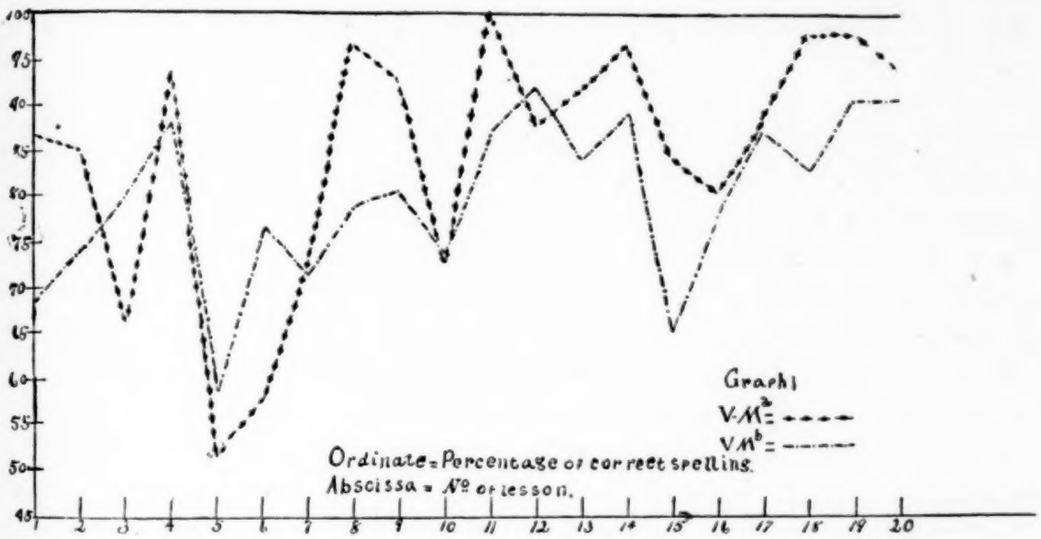
Sections.	V-M^a			V-M^b			A-M^a			A-M^b			A-V-M^a			A-V-M^b			A-V-M^c		
First Series:	Error.	Msp.	W. W.	Error.	Msp.	W. W.	Error.	Msp.	W. W.	Error.	Msp.	W. W.	Error.	Msp.	W. W.	Error.	Msp.	W.W.	Error.	Msp.	W.W.
I.....	11	11	6	30	25	20	4	4	4	13	13	8	17	17	12	8	8	8	9	8	8
II.....	14	12	8	27	21	20	2	2	2	8	8	6	12	11	9	24	20	16	18	17	15
III.....	29	27	15	26	15	14	10	8	7	20	18	11	15	11	8	26	23	18	29	24	17
IV.....	6	5	5	12	10	9	3	3	3	6	6	4	15	11	7	16	13	10	13	13	13
V.....	44	39	22	45	33	22	20	18	15	35	28	16	34	28	19	37	30	22	30	25	19
VI.....	43	34	19	28	19	16	8	7	6	18	18	14	34	24	18	34	24	18	27	23	15
VII.....	26	22	15	29	23	21	13	12	11	22	22	14	19	17	13	32	24	15	22	20	18
VIII.....	3	3	2	20	17	13	4	4	4	12	10	8	12	11	9	18	16	13	19	14	10
IX.....	7	6	5	20	16	15	1	1	1	17	15	10	14	14	11	15	13	10	19	18	17
X.....	26	22	14	25	21	20	4	3	3	9	7	6	10	10	8	21	18	14	14	13	11
Total.....	209	181	111	262	201	170	69	62	56	160	145	97	182	154	114	231	189	144	200	175	143
Second Series:																					
I.....	0	0	0	13	11	9	0	0	0	10	7	6	17	14	11	2	2	2	5	4	4
II.....	11	10	7	12	7	7	1	1	1	6	6	4	5	5	4	6	5	4	4	4	4
III.....	8	7	7	16	13	12	0	0	0	2	2	2	4	4	3	4	4	4	5	5	5
IV.....	4	3	3	11	9	7	0	0	0	1	1	1	1	1	1	5	4	4	2	2	2
V.....	17	13	9	37	28	24	2	2	2	11	8	8	2	2	2	15	13	9	7	5	5
VI.....	20	16	9	21	18	16	0	0	0	7	5	5	10	9	8	9	9	9	5	4	4
VII.....	12	10	7	14	11	9	0	0	0	7	5	4	1	1	1	11	9	7	8	6	6
VIII.....	2	2	1	16	14	13	0	0	0	3	3	2	3	3	3	8	6	5	7	5	5
IX.....	2	2	2	13	8	8	1	1	1	3	3	2	3	3	3	3	3	3	1	1	1
X.....	6	5	5	10	8	7	0	0	0	1	1	1	3	2	2	3	3	3	2	2	2
Total.....	82	68	50	163	127	112	4	4	4	51	41	35	49	44	38	66	58	50	46	38	38
Grand t'l..	291	249	161	425	328	282	73	68	60	211	186	132	231	198	152	297	247	194	246	213	181

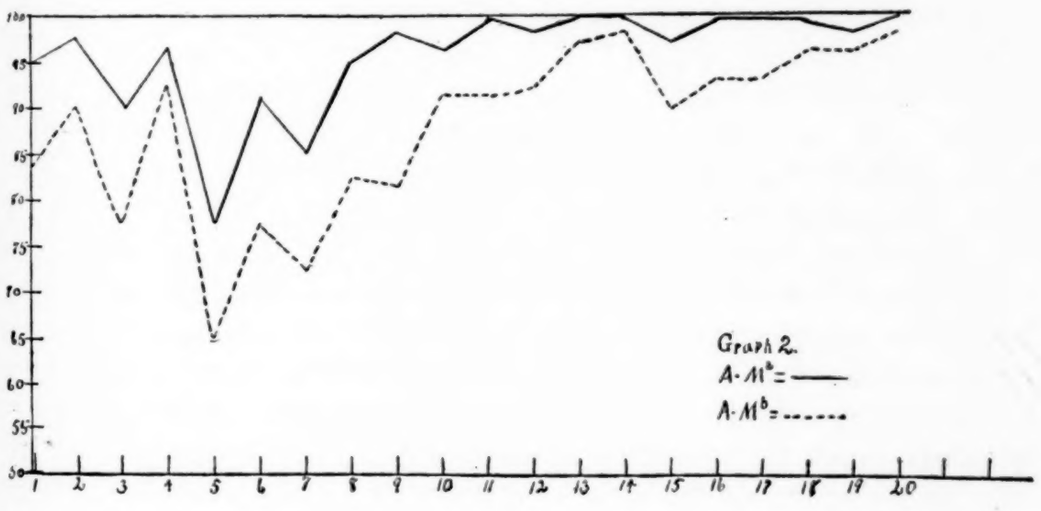
by 14.12 per cent. and 9.24 per cent., respectively, thus showing a greater progress in the learning rate of the Favored Section. Again, the V-Ma Section reduced its mean variation from 13.38 per cent. in the first series to 5.5 per cent. in the second, while the V-Mb Section actually increased its variation by 0.24 per cent. in the second series—additional evidence of the greater progress of the Favored Section.

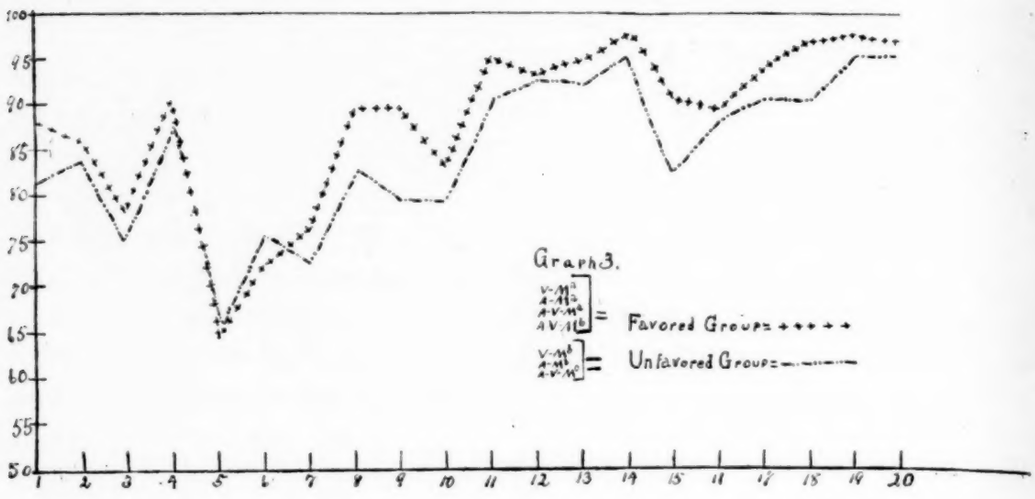
The Favored Section of the A-M Group surpassed that of the Unfavored in correct spelling throughout the twenty lessons (see Table III). The difference in the average of the percentages of the first and second series of the Favored Section of this Group is smaller than that of the Unfavored. This fact cannot be interpreted, however, as due to a slower rate of learning, but rather to a much higher percentage attained by the Favored Section in the first series, thereby foreshortening the opportunity for progress. The Favored Section reduced its mean variation from 5.05 per cent. to 0.68 per cent., while the Unfavored stands 7.14 per cent. in the first and 2.63 per cent. in the second. A comparison of the results of the two Favored Mixed Sections, A-V-Ma and A-V-Mb, with those of the Unfavored, A-V-Mc, yields uncertain evidence. The percentage of correct spelling of the Unfavored exceeded the averages of the other two in thirteen out of twenty lessons, and the difference between the average percentages of correct spelling in the first and second series for this Section is 16.37 per cent., while that of the Favored Sections is only 15.07 per cent. Again, the former reduced the mean variation from 6.38 per cent. in the first series to 1.59 per cent. in the second and the latter from 6.6 per cent. to 3.56 per cent., respectively, for the same series, so that on all three counts the credit is to the Unfavored. Of the two Favored Sections of this mixed group, the "b" Section is largely responsible for this slow rate of learning, due, perhaps, to their low spelling ability and to the large number, 53.37 per cent., of *new* and *doubtful* words credited to them. Attention is called to the results of this Section because they employed all the usual modes of learning known to current pedagogy. Were they embarrassed by so many methods? Their introspections

show throughout that they were favored rather than embarrassed by the methods.

A comparison of the Unfavored and Favored Sections as a whole shows that the Favored have a higher percentage of correct spelling in every lesson of the first series save in the fifth and sixth, and that in the second series they excel in every lesson. The comparative results of the two Sections are expressed in Graph 3. All Sections commented on the unusual number of difficult and strange words in the fifth and sixth lessons, which accounts for the excessive decline of the graphs at these points. And that the curve of the Favored should







dip below that of the Unfavored is probably due to the fact that the V-Ma and the A-V-Mb Sections encountered a larger proportion of unfamiliar words at that point. The relation between the curves of the V-M group in Graph 1 justifies this view, in that the Favored dip far below the Unfavored. In the second series the curves of both Sections decline again in Graph 3 at the fifth lesson (fifteenth in the whole series), but this time the Unfavored suffer most—an indication that the conditions did not permit them to learn as many words. The relation of the curves in the nineteenth and twentieth lessons suggests that the Unfavored are there overcoming their handicaps.

Errors.—There were in all 1774 errors, 1313 of which occurred in the first series, 461 in the second. One hundred and forty-four mistakes, classed as "false impressions," due to faulty pronunciation by the monitors, are omitted from the following account of errors. The remaining 1630 were classified according to the rubrics indicated in Table IV. This classification, following the lead of Prof. O. P. Cornman (2, pp. 26-29) in his studies of spelling errors, is based on the assumption that errors are due to incoördinations of the sensori-motor mechanism. "It is possible to distinguish between error due to some imperfection of the motorial elements of the spelling process—and those errors which result from some defect in the assimilation of sensory elements, an incoördination on the

TABLE III.

Percentages of Correct Spelling.

	SERIES I.								SERIES II.							
	Favored.					Unfavored.			Favored.					Unfavored.		
	V-M[a]	A-M[a]	A-V-M[a]	A-V-M[b]	Total.	V-M[b]	A-M[b]	A-V-M[c]	Total.	V-M[a]	A-M[a]	A-V-M[a]	A-V-M[b]	Total.	V-M[b]	A-M[b]	A-V-M[c]	Total.
I.....	83.3	95.0	78.8	90.0	87.52	68.8	83.8	90.0	80.86	100.0	100.0	82.5	97.5	95.00	86.3	91.3	95.0	90.86
II.....	85.0	97.5	86.3	75.0	85.95	73.8	90.0	86.3	83.70	87.5	98.8	93.8	93.8	93.47	91.3	92.5	95.0	92.93
III.....	66.3	90.0	86.3	71.3	78.47	80.0	77.5	70.0	75.83	91.3	100.0	95.0	95.0	95.32	83.8	97.5	93.8	91.70
IV.....	93.8	96.3	86.3	83.8	90.05	87.5	92.5	83.8	87.93	96.3	100.0	98.8	95.0	97.52	88.8	98.8	97.5	95.03
V.....	51.3	77.5	65.0	62.5	64.09	58.8	65.0	68.8	64.20	83.8	97.5	97.5	83.8	90.65	65.0	90.0	93.8	82.93
VI.....	57.5	91.3	70.0	70.0	72.29	76.3	77.5	71.3	75.03	80.0	100.0	88.8	88.8	89.40	77.5	93.8	95.0	88.76
VII.....	72.5	85.0	78.8	70.0	76.56	71.3	72.5	75.0	72.93	87.5	100.0	98.8	88.8	93.77	86.3	93.8	92.5	90.86
VIII.....	96.3	95.0	86.3	80.0	89.40	78.8	87.5	82.5	82.93	97.5	100.0	96.3	92.5	96.57	82.5	96.3	93.8	90.86
IX.....	92.5	98.8	82.5	83.8	89.40	80.0	81.3	77.5	79.60	97.5	98.8	96.3	96.3	97.22	90.0	96.3	98.8	95.03
X.....	72.5	96.3	87.5	77.5	83.45	73.8	91.3	83.8	82.96	93.8	100.0	97.5	96.3	96.90	90.0	98.8	97.5	95.43
Total Avgs..	77.40	92.27	80.78	76.39	81.71	74.91	81.89	78.90	78.56	91.52	99.51	94.53	92.78	94.58	84.15	94.91	95.27	91.44

TABLE IV.

Analytic Classification of 1600 Sensory and Motor Errors.

	SERIES I. Favored Sections.						Unfavored Sections.						SERIES II. Favored Sections.						Unfavored Sections.					
	V-M[a]	A-M[a]	A-V-M[a]	A-V-M[b]	Percentage of average.	Totals.	V-M[b]	A-M[b]	A-V-M[c]	Percentage of average.	Totals.		V-M[a]	A-M[a]	A-V-M[a]	A-V-M[b]	Percentage of average.	Totals.	V-M[b]	A-M[b]	A-V-M[c]	Percentage of average.	Totals.	
Motor Errors:	%	%	%	%			%	%	%				%	%	%	%			%	%	%			
a. Simple.																								
1. Omission	1.226	.245	1.349	2.024	1.212	79	1.534	1.288	.859	1.226	60		.982	.061	.552	.552	.537	35	1.349	.123	.307	.593	29	
2. Addition	.552	.184	.245	.307	.322	21	1.043	.491	.613	.716	35		.061	00	.245	.061	.092	6	.552	.061	.184	.266	13	
3. Change	1.349	.920	1.717	2.209	1.549	101	2.086	1.472	1.288	1.615	79		.920	.123	.061	.675	.444	29	1.288	.798	.429	.838	41	
4. M and N	00	00	.061	00	.015	1	.307	00	.067	.124	6		00	00	.061	00	.015	1	.123	00	00	.041	2	
Percentage of totals	3.128	1.349	3.374	4.539	3.098	202	4.969	3.252	2.822	3.681	180		1.963	.184	.920	1.288	1.089	71	3.313	.981	.920	1.738	85	
b. Suggestion.																								
1. Transposition	.123	00	.552	.368	.261	17	.245	.429	.429	.368	18		00	00	.061	.061	.031	2	00	.245	00	.082	4	
2. Wrong letter doubled.	00	00	.061	.061	.031	2	.061	00	.061	.041	2		00	00	00	.061	.015	1	00	.061	00	.020	1	
3. Sensori-Motor Attraction	.245	00	.123	.061	.107	7	.061	.061	.184	.102	5		00	00	00	.123	.031	2	.061	00	.061	.041	2	
4. Ideo-Motor Attraction.	1.043	.429	.675	.859	.752	49	.552	.613	.920	.695	34		.061	00	.061	.245	.092	6	.368	.123	.307	.266	13	
Percentage of totals	1.411	.429	1.411	1.349	1.150	75	.920	1.103	1.595	1.206	59		.061	00	.123	.491	.169	11	.429	.429	.368	.408	20	
Percentage of total motor errors	4.539	1.779	4.785	5.889	4.249	277	5.889	4.356	4.417	4.880	239		2.024	.184	1.043	1.779	1.258	82	3.742	1.411	1.288	2.147	105	
Sensory Errors.																								
a. Phonetic	2.024	1.411	1.103	1.656	1.549	101	3.374	1.717	1.717	2.270	111		.982	00	.307	.184	.368	24	2.024	.429	.491	.982	48	
b. Confusing.																								
1. ei, ie, able, ible, etc.	2.761	.429	2.577	4.233	2.500	163	3.313	1.288	3.558	2.714	133		1.103	00	.982	1.165	.813	53	1.534	.491	.675	.900	44	
2. Doubling	1.165	.307	.798	.368	.660	43	1.165	0.798	1.411	1.125	55		.307	.061	.429	.491	.322	21	.675	.307	.307	.429	21	
3. Non-Doubling	0.859	.123	1.165	.859	.752	49	.798	.982	.491	.757	37		.184	00	.123	.307	.153	10	.552	.307	00	.286	14	
Percentage of total sensory errors	6.809	2.270	5.644	7.117	5.460	356	8.650	4.785	7.177	6.871	336		2.577	.061	1.840	2.147	1.656	108	4.785	1.534	1.472	2.597	127	
Perc't'ge of grand totals.	11.349	4.049	10.429	13.006	9.708	633	14.539	9.141	11.594	11.758	575		4.601	.245	2.883	3.926	2.914	190	8.527	2.945	2.760	4.744	232	

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receptive side of the language process, evidenced by the incorrect association of the letters in the written words."

The motor errors (see Table IV) were divided into eight classes, four of which were termed *simple*, and four, owing to their relation to suggestive processes, were classed under *suggestion*. The four classes of the former are:—*omission, addition, change* and *interchange of m and n.* These sub-classes need no further definition. The motor errors classed under suggestion may best be explained by examples:—*Transposition*, as *Beduoin* for *Bedouin* or *byrel* for *beryl; Wrong letter doubled*, as *abbattoir* for *abattoir* or *Lyonaisse* for *Lyonnaise; Attraction, Sensori-motor, beetel-nut* for *betel-nut* or *ananesia* for *amnesia.* This class of errors involves an incorrect repetition of a prominent letter in the word, or it may involve the insertion of a letter or combination of letters involved in a previously written word, *e. g., exceedible* (exceedable) follows *evincible*, also *bandana* (bandanna) follows *banana; Attraction, Ideo-motor*, these errors consist in the substitution of a letter or arrangement of letters from a somewhat similar word in the lesson or from an irrelevant associated word. Examples of the former are *indefencible* (indefensible) followed later by *inducible* and of the latter are *gargoil* (gargoyle) and *grystal* (gristle), associated, respectively, with *recoil* and *crystal*, words that did not occur in the lesson.

The sensory errors fall into two large groups, *Phonetic* and *Confusion.* The phonetic errors of our language are legion and call for no illustration. Confusing errors are of three classes, *Special cases, Doubling*, and *Non-doubling.* Confusing errors are shown both in letters and in syllables. Of letters often confused were, *y* and *i; s, c* and *z; c, ch* and *k; e* and *i; f* and *ph;* and of syllables, *er, ar* and *ir; ae* and *ea; ei* and *ie; al, le* and *el; il, ile, eel* and *ele* and *eal; u, eu, ieu* and *ewe; si* and *ci; ice* and *ise; cian* and *tian; cion* and *tion; cal* and *cle; ant* and *ent; cleis* and *clys; eous* and *ious; dcen* and *dine; cene* and *cine; oil* and *eyle; able* and *ible; clep* and *clyp.* The errors of *doubling* consist of using double letters for single ones, as *Dannish* for *Danish;* and those of *Non-doubling* are self-evident. Confusing errors may at times be purely phonic, especially those of similar pronunciation, *e. g.*, "ice" in *chalice* was spelled phonetically "is," and then again it was confused with "is" in *clevis* and *aphis*, and this according to the Cornman classification might be considered sensori-motor-attraction, instead of a phonic confusion. Oft-recurring instances of this type and of still others raised a question as to the usefulness of Cornman's classification.

The basis of his classification is fundamental in that it assumes that the errors are due to defects in parts of the sensori-motor mechanism, yet it leads to confusion, for it fails to separate errors of *fact* from errors of *cause.* Spelling errors of fact are of four kinds and only four:—omission, addition, transposition and substitution. We may dogmatize about these, for they permit definite and exact classification. But we do not yet know the number of causes of errors; oftentimes, the number of causes of even one error cannot be determined. The mixture of these two forms of errors—fact and cause—produces difficulties of this sort; *appall* is spelled *appal.* Is this a sensory error of non-doubling, or an error of the ideo-motor type? Of course, as to fact, it is an error of omission and nothing else. Again, *liturgic* is spelled *litergic.* Is this an ideo-motor, or a sensory error of the phonic type? As an error of fact, it is substitution. To spell *guerilla* as *gorrilla* may be either a phonic error or a form of motor lapse, but as to the error of fact there can be no doubt. Again, an error may be the joint product of both sensory and motor causes. For these reasons, it would seem to be in the interest of clearness and accuracy to classify errors *first* as to fact and then ascribe the most probable cause or causes; this would prevent motor and sensory causes from mutually excluding each other. The Cornman method is here used because the monitors based their records upon it, while the one here suggested occurred to me later in working over their records.

Table IV shows the distribution of errors among the several Sections. In general, the percentages of sensory errors exceed those of the motor in both series for all Sections. The percentage of the average of the grand total of errors for the Favored and Unfavored in the first series is 9.708 per cent. and 11.758 per cent., respectively, and in the second series 2.914 per cent. and 4.744 per cent., thus showing that the Favored progressed approximately 1.3 times faster than the Unfavored.

Motor errors were eliminated 1.5 times faster and sensory errors 1.2 times faster by the Favored than by the Unfavored. If the elimination of motor errors is due to an improvement in the habit-mechanism, then it appears that the Favored Group acquired this segment of the spelling arc more rapidly. Motor errors of suggestion, sensory errors of the phonic and of the confusion types were eliminated, respectively, by the Favored 2.4, 1.8 and 1.00 times faster than by the Unfavored. The Unfavored eliminated 1.27 times as many errors of the *doubling* as the Favored, while the latter in turn eliminated 1.8 times as many errors of *non-doubling,* from which it seems that an individual spelling with his type tends to double the letters, while one spelling against it omits required repetition. Is this an illustration of Baldwin's "self-imitation" under favorable conditions of expression? Both groups make the least progress with *confusing* errors.

A somewhat finer measure of comparative progress is found in the ratio of "wrong-words" to errors. If the wrong-words and errors are equal, the ratio is unity. The better the speller, the greater are the chances for the ratio becoming unity, *e. g.,* the A-Ma section proved to be the best spellers and in the second series their ratio of wrong-words to errors is unity. In the first series these ratios are 22/42 (V-Ma), 37/42 (A-Ma), 28/42 (A-V-Mb), 24/42 (A-V-Mb) and for the Unfavored 28/42 (V-Mb), 24/42 (A-Mb), 28/42 (A-V-Mc); in the second series they stand, Favored 25/42 (V-Ma), 42/42 (A-Ma), 32/42 (A-V-Ma), 32/42 (A-V-Mb); Unfavored 28/42 (V-Mb), 28/42 (A-Mb), 30/42 (A-V-Mc). These values show that the Favored increased their ratio 5/42 and the Unfavored 2/42.

Aids.—The A-Ma and A-V-Mb considered and used syllabi-

cating as an aid. The A-V-Mc section was required to use it, and found it a hindrance during the first series, though it proved an aid as the end of the second series approached. The A-Mb and the A-V-Ma reported aid from the writing movement; all of these *S's* save K. K. were graph-motor. The A-V-Mb found its own pronunciation an aid, and all of the mixed group mentioned rules of spelling as an aid.

Difficulties.—All our subjects unite in saying that double consonants, confusing letters and syllables, and similar sounds of different letters are difficulties; all Unfavored reported frequent inability to image the words in their dominant type during the first series, the difficulty decreased in the second. M. Ch. says: "I seem so dependent upon visual imagery for correct spelling that after the words are pronounced I must see them syllable by syllable before writing them. If the word is unfamiliar, I visualize it as I spell it. With familiar words I am independent of imagery."

Doubt.—"Anticipatory processes" are likely to create doubt, as all *S's* reported. These processes are more numerous in spelling unfamiliar and partially learned words, and the extent of their vividness appears to be a rough measure of the degree of doubt. The manner of the monitor's pronunciation to the V-Mb and the A-Mb sections created doubt.

Certainty.—All sections considered "report processes" as producing certainty of the accuracy or inaccuracy of the spelling product. The auditory types reported that both the sound and speech-motor perceptions increased certainty. The visual image increased certainty for the V-Ma and the "b" and "c" sections of the mixed groups, as did the sound of the letters, of the words, of own voice and voices of others in the A-Ma, A-Mb and in the "b" and "c" sections of the mixed groups.

Distractions.—Consciousness of having missed a word, loud talking, others working in the same room, students passing to classrooms, fatigue, uncomfortable temperature, were common distractions. The Unfavored groups were distracted during the first series by the imposed conditions, but as indicated above, this source of disturbance was considerably lessened in the second series. The thought of other school work and the brief time in which to write introspections were disturbances.

Summary and Comment.

1. The Favored Sections eliminated all forms of motor errors and nearly all forms of sensory more rapidly than the Unfavored.

2. Using a subordinate receptive mechanism of a spelling arc caused a greater check on the learning rate than the use of a less preferred emissive mechanism.

3. It appears that where an arc has been established conformable to the individual's dominant imaginal type, if words be presented to a subordinate type, they may be translated into the imagery of the preferred type.

4. Interference with the preferred form of expression proved a handicap in the first series, but became a negligible quantity toward the end of the second; on the contrary, interference with the dominant receptive mechanism persisted fairly uniformly throughout both series.

5. The several possible components of the spelling arc have their greatest significance during the learning stage, and the less serviceable are eliminated as the habit stage approaches [inferred from the subjects' introspections].

6. Anticipatory processes are likely to create doubt, while report processes produce certainty.

It was the intention to submit a new list of 400 words to the same subjects under similar procedure, but with the difference that the Favored and Unfavored Sections should exchange places. Such a course seems highly desirable in work of this kind, both as a check and as a means of detecting sources of error.

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SOME OBSERVATIONS ON THE LEARNING OF SENSIBLE MATERIAL.

JOHN A. DELL, M.SC.,

Assistant Master, Sexey's School, Bruton, Somerset, England.

SUMMARY.

Three experiments were made on the Learning of Sensible Material with the object of discovering whether the position of facts in a series has any such influence on their likelihood of being remembered as has been shown to be the case with nonsense material. The material used in this experiment consisted of (1) a lecture entitled "Fifty Years of Punch," (2) a lesson on buds, (3) two courses of lessons, one in chemistry and the other in nature study, extending over a term of three months.

In all cases it was found that position in the series had negligibly small influence upon remembrance in comparison with effects due to other causes.

THE "LECTURE" EXPERIMENT.

A lecture was given at Sexey's School, Bruton, on "Fifty Years of Punch," illustrated by lantern slides. The lecture presented a series of slides taken from pictures which had appeared in Punch, and each slide was briefly described by the lecturer. Attendance at the lecture was purely voluntary, but a large proportion of the scholars were present. The lecture lasted an hour and a half.

Eight days later those who had been present at the lecture were asked to submit themselves to a memory test. Thirty of those who had attended expressed their willingness to do so, and they were then asked to write down in as brief a manner as possible a recognizable description of each of the slides they had seen. In most cases a single phrase was enough to indicate whether a particular slide had been remembered or

not, but in a few ambiguous cases the writers were asked privately for a fuller verbal explanation. In this way the number of individuals who remembered each slide was determined with practical certainty. The following table shows the numbers of individuals who recalled each slide of the series. No frequencies are recorded against numbers 8, 12, 45, 47, 49, 53, 58, 61, 64, 67, 72, 73 on account of an ambiguity in the printed list of slides by means of which these results were corrected.

TABLE I.—*Frequency with which slides of Punch lecture were remembered.*

No.	Frequency	No.	Frequency.	No.	Frequency.	No.	Frequency.
1	13	21	8	41	6	61	..
2	14	22	12	42	9	62	4
3	24	23	14	43	2	63	4
4	9	24	18	44	2	64	..
5	12	25	8	45	..	65	3
6	15	26	6	46	0	66	5
7	12	27	2	47	..	67	..
8	..	28	7	48	1	68	1
9	7	29	11	49	..	69	5
10	11	30	7	50	3	70	5
11	4	31	3	51	3	71	1
12	..	32	21	52	7	72	..
13	8	33	1	53	..	73	..
14	14	34	5	54	6	74	0
15	2	35	1	55	3	75	6
16	12	36	6	56	10	76	2
17	16	37	7	57	1	77	13
18	17	38	4	58	..	78	0
19	30*	39	10	59	0	79	6
20	9	40	10	60	7	80	2

*Number 19 was described to those who were being tested as an example of the way in which results were to be written down. It accordingly appears on every paper.

COMPARISON OF THIS RESULT WITH THE RESULT OF LEARNING A NONSENSE SERIES.

Bolton[1] has shown that of a series of figures arranged in a meaningless order, those near the ends of the series are most likely to be remembered. He writes on this point: "This will be true of any series of successive ideas. They are permanent in inverse order as they are removed from the beginning, except the last two or three, which are permanent in their order from the last."

The series of ideas forming the subject of this experiment shows, like Bolton's, a gradual falling off as we pass along it

(1) American Journal of Psychology, iv, 1891, p. 362.

from the beginning with a rather questionable rise again at the end. This is more clearly seen if the results are grouped so as to show the average frequency of positions of the curve lying between successive minima:—

TABLE II.

Group	1-15	16-27	28-35	36-46	47-59	60-74	75-80
Average frequency	11.2	11.1	7.0	5.6	3.8	3.5	4.8

It is certain, however, that there are other causes at work which produce fluctuations much greater than any effect due merely to position.

THE LESSON EXPERIMENT.

A lesson on buds was given independently to two forms, which contained 16 and 21 boys, respectively. The facts of the lesson were derived from observations made by the class under the direction of the teacher. The facts may be classed in three groups, and in giving the lessons the groups of facts were arranged in different orders. The following scheme shows the order in which the groups of facts were taken in the two classes:

FORM I—16 BOYS.	FORM II—21 BOYS.
1. Arrangement of Scales.	1. Arrangement of buds on shoot.
2. Contents of buds.	2. Arrangement of Scales.
3. Arrangement of buds on shoot.	3. Contents of bud.

Each class was tested by a short series (10) of oral questions at its next meeting. These questions were framed with the most scrupulous care to avoid suggesting answers (which is one reason why so few were used), and were asked in the same order on both occasions. Questions were chosen which could be answered by a single word or a short sentence.

The answers were arranged in three groups, according to the section of the lesson with which they dealt, and the percentage of frequency of correct answers was determined. In this way the following table was computed:

TABLE III.

Subject of Question.	*Form I.* % Frequency of correct answer to each question.	*Form I.* Average % Frequency of correct answer to question in each group.	*Form II.* % Frequency of correct answer to each question.	*Form II.* Average % Frequency of correct answer to question in each group.
Scales of single bud.	37.5 37.5	37.5	89.5 19.1	54.3
Contents of bud.	68.9 87.5 37.5 43.8	59.4	89.5 76.2 66.7 38.6	67.8
Arrangement of buds.	62.5 43.8 18.8 31.3	39.1	89.5 89.5 33.3 38.6	62.7

Inspection of the right-hand columns under Form I and Form II, respectively, shows that the probability of obtaining a correct answer is greatest for a question in Section II, next greatest for Section I and least for Section III, although the subject-matter of these sections occupied different positions in the lessons given to the two forms. The fact that pupils of Form II are more likely to get a correct answer in any section than those of Form I is explained by their greater age and by their previous training, since a number of them had already passed through Form I.

These results strongly confirm those of the "lecture" observations. When a series of facts having a rational relation to one another is learnt, the chance of their being remembered depends to a negligible extent upon the order in which they are presented, and much more upon entirely different causes.

EXPERIMENTS LASTING FOR A WHOLE TERM.

Form III was examined on a single term's work in chemistry by means of carefully-arranged short questions of the same character as those suggested in the last experiment. Forms I and II, in both of which the pupils had been doing the same work, were examined in the same way in nature study. The answers were then corrected and the results arranged in the order in which the facts had been dealt with during the term. These results are shown in Tables IV and V. The frequencies indicated are *actual,* not percentage, frequencies.

TABLE IV.—*Frequency with which facts dealt with in a course of Nature Study lessons were remembered by Forms I and II.*

No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.
1	34	11	36	21	8	31	33	41	35
2	37	12	36	22	19	32	29	42	19
3	31	13	34	23	24	33	24	43	26
4	32	14	36	24	28	34	27	44	29
5	24	15	35	25	28	35	33	45	15
6	17	16	31	26	34	36	28	46	35
7	27	17	26	27	34	37	26	47	33
8	36	18	30	28	27	38	25	48	9
9	7	19	19	29	29	39	9	49	32
10	25	20	30	30	33	40	33	50	32

TABLE V.—*Frequency with which facts in a course of Chemistry lessons were remembered by Form III.*

No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.	No. of Question.	Frequency of Correct Answer.
1	33	11	28	21	21	31	14	41	15
2	27	12	25	22	25	32	23	42	13
3	28	13	15	23	33	33	12	43	27
4	21	14	17	24	23	34	28	44	29
5	33	15	14	25	28	35	19	45	16
6	28	16	28	26	26	36	18	46	9
7	22	17	13	27	9	37	16	47	22
8	24	18	19	28	22	38	10	48	21
9	17	19	16	29	32	39	25	49	26
10	18	20	13	30	15	40	26	50	13

Tables VI and VII present the results grouped so as to show the average frequency of portions of the curve lying between successive minima, as in Table II.

TABLE VI.—*Grouping of the Results of Table IV.*

Group	1-9	10-21	22-39	40-50
Average frequency	27.2	28.8	26.6	27.1

TABLE VII.—*Grouping of the Results of Table V.*

Group	1-17	18-38	39-50
Average frequency	23	20.1	20.2

These results agree perfectly with the previous ones. In both cases there is only the slightest indication (in one case none) that special parts of the series are remembered better than others in virtue of their position. In any case such differences as do occur are completely insignificant in comparison with larger fluctuations due entirely to other causes.

When a series of meaningless syllables is learnt they are connected in the mind by associations depending almost entirely on their contiguity in space or time. In rational learning, on the other hand, the associations formed depend almost entirely on associations by similarity with various facts, many of which form no part of the memorized series at all, but have been present in consciousness before. The learner, in fact, builds up in his own mind a number of series concurrently, and when a new fact is presented to him he places it in what seems to him its correct position in some series already in his mind.

Other things being equal, the beginning and the end of a lesson are the best places for facts which have to be remembered; generally speaking, however, other things are *not* equal, and it is not worth while to alter the natural sequence of the facts in order to bring any particular fact to the beginning or end.

THE
JOURNAL OF EDUCATIONAL PSYCHOLOGY
INCLUDING EXPERIMENTAL PEDAGOGY, CHILD PHYSIOLOGY AND HYGIENE, AND EDUCATIONAL STATISTICS

Edited by
W. C. BAGLEY, C. E. SEASHORE,
J. CARLETON BELL, Managing Editor. GUY MONTROSE WHIPPLE.
Published monthly except July and August by
WARWICK & YORK, INC.,
BALTIMORE, MD.

Manuscripts for publication, books or other material for review, and news items of interest to educational psychologists should be addressed to The Managing Editor, J. Carleton Bell, University of Texas, Austin, Texas. Research contributions from England may be sent to W. H. Winch, Esq., Melville Villa, Overhill Road, Dulwich, London.

The Journal is issuing a series of Monograph Supplements for the publication of more extensive researches in educational psychology. For details prospective contributors may apply to Guy Montrose Whipple, Cornell University, Ithaca, N. Y.

The price of the Journal in the United States, Canada and Mexico is $1.50 a year. Foreign subscriptions 7s. 5d. in England; M7.60 in Germany; 9.30f. in France and the equivalent in other foreign countries.

Subscriptions and correspondence concerning business matters should be sent to Warwick & York, Inc., Baltimore, Md.

VOLUME III SEPTEMBER, 1912. NUMBER 7

EDITORIALS.

THE ETHICS OF OFFICE-SEEKING.

It is natural for men and women to seek that type of pre-eminence among their fellows which is represented by election to office. It is essential and therefore justifiable for a man or a woman who wishes to establish a principle or a policy to stand explicitly for an office of power and influence, and to work frankly for his or her own election. The notion that the ballots of an electorate will be given spontaneously to the most competent individual is an anachronism in the theory of democracy.

Accepting these two conditions, however, there are certain limits beyond which the game of politics should be prohibited. The critical stage of educational development through which we are now passing imperatively demands that all personal, sectional and partisan interets be absolutely and rigidly eliminated from the elections of the N. E. A. Whether a candidate comes from the East or from the West, from the North or from the South, should make not the slight-

est difference. Whether the candidate is a man or a woman ought not to be a factor in the selection. Education has problems to solve that are far too significant and insistent to be relegated to the background while educators engage in a petty squabble over matters that are of purely personal, sectional or partisan consequence. If the N. E. A. is to be a constructive force in the solution of these problems, it must be imbued with the truly social and democratic spirit: to paraphrase one of Thorndike's statements, it must stand firm on the principle that it is of small moment who is at the top or who is given the power to achieve something for the common good; it is a matter of vital import that the top be high and that much be achieved.

The great danger in the present methods of selecting our titular leaders is that they are likely to favor the person who itches for the title rather than for the opportunity, and to handicap the person who could do much with the opportunity, but who shrinks from the methods that alone would enable him to enjoy it. W. C. B.

POLITICS IN THE N. E. A.

In spite of an unusually good program at the Chicago meeting of the N. E. A., the attention of the public and of a certain proportion of the membership was concentrated upon "political" issues. The stenographic report of the Wednesday noon business meeting (if it is printed *verbatim*) will make interesting reading for the future historian of twentieth century civilization. (And this historian, by the way, will study our educational documents pretty carefully whether we wish him to or not.) To make the picture complete, however, it would be necessary for him to have both phonographic and kinetoscopic records of the proceedings. It was a spectacle of which present-day education can scarcely be proud,—and yet it had its value.

If the N. E. A. is a force for either good or evil in American education (and it certainly is a force), we should be glad to know how its policies are directed. The candor that characterized Miss Strachan's address was refreshing, and her statements relating to the manner in which her candidacy for the office of president had been met were not denied, although counter charges were presented relating to alleged phases of her own activity. If either secret caucuses or attempts to influence teachers through Mayors and boards of education are essential to the effective management of the N. E. A.,

the general membership should be informed of the situation. It is possible, of course, that so large and important an organization can be operated only by the methods of political manipulation,—the "packing" of meetings, the use of "influence" and pressure, and the various other devices by means of which the policies of the few may be made to "represent" the unanimous judgment of the many. It is conceivable that the welfare of the many is adequately conserved and promoted by these methods. It is possible that these are the only methods that will "get results." But if all this is true, why not admit once and for all that democracy is a failure, that its apparent triumphs are only artifacts, and that back of the pretty puppets through which the collective will of the group appears to be expressed two or three or fifteen or twenty individuals really pull the strings and work the "whole show?" W. C. B.

THE EFFECTS OF THE PROBATION SYSTEM.

The Police Commissioner of New York City has complained that some of the city magistrates are nullifying the efforts of the police, defeating the ends of justice, and fostering crime by an indiscriminate use of probation methods and suspended sentences. It is claimed that of some six thousand convictions for crimes and misdemeanors during the past year over four thousand have been followed by suspended sentences or some form of probation. This leniency, it is charged, has been interpreted as license by the criminal world, crime is committed with a deliberate expectation of a suspended sentence, and the police find themselves powerless to cope with criminal activities.

In his recent report as director of the Gatzert Foundation, Dr. Stevenson Smith points out that leniency toward criminals is most successful when it is first practiced, and that as probation becomes more general it is less effective. The value of probation depends entirely upon the mental attitude of the probationer. We need much more careful studies of individual cases with reference to the mental habits previous to the crime, and the attitude of the culprit toward his crime and toward society after his conviction, in order to secure the best results from the probation system. J. C. B.

THE CORRELATION OF THE FOUR AGES: A NEGLECTED FIELD OF INVESTIGATION.

The advent of the Binet-Simon tests has stimulated investigation of the correlation between mental and chronological age, and recent studies in school retardation have drawn attention forcibly to the correlation between chronological age and pedagogical age. Less attention seems, however, to have been accorded to the several attempts to devise tests for physiological age. Yet, if a satisfactory objective measure of physiological development could be secured, the way would be opened for mass tests of the interrelations of these four ages. For, in theory, any child may exhibit retardation or acceleration in any one of these four ages when it is related to any other one of them. Thus far, the tests of physiological age which have been suggested are the progress of dentition, the presence or degree of development of pubescence, stature and the epiphyseal development of the wrist-bones, as determined by the Röentgen-ray method. So far as we know, no one has attempted a thorough-going experimental comparison of these several methods of determining physiological age, though not until this has been done can we proceed to the study of the interrelations of the four ages under consideration. Moreover, the results now available are conflicting. Dr. W. L. Foster believes that the relation of stature and pubescence is so close that a practical grouping of pupils could be made on the basis of stature alone. Dr. Rotch declares that height and weight might correspond with chronological age, but delayed mental development would be indicated by the metabolism of the epiphyses. Again, Foster's statistics show that discharges from the secondary school are more numerous in the more mature pupils and promotions more frequent in the less mature pupils of the same class, whereas Crampton asserts that in the secondary school the immature (prepubescent) boys of all ages present many more instances of failure in school work. Into the validity of these various assertions this is not the place to go; they are cited to call attention to the need of further experimental and statistical study of the correlation of chronological, pedagogical, psychological and physiological age.

G. M. W.

NOTES AND NEWS.

The Institute of Applied Psychology, in Berlin, announces that the recent exhibition of the materials and resources of the Institute at the congress of experimental psychology was highly successful, and was visited by a large number of teachers and laymen. So great was the interest manifested that the Prussian Minister of Education offered the Institute a room in the building of the German Educational Museum of the City of Berlin for a permanent exhibit of its collections, and they may now be seen there any afternoon from 4 to 6. At the suggestion of the International Union for the Advancement of Science, it is proposed to enlarge the collections of test materials, with a view to making the Institute a "Center for Psychographic Investigations."

One hundred and twenty-four Pittsburgh teachers enjoyed the benefits of the Educational Fund this summer, having their expenses paid during their attendance at summer schools. Of these, thirty-three went to Columbia, thirty to Carnegie Institute of Technology, nineteen to Chatauqua Summer School, fourteen to Harvard, six to Cornell and the remainder to various institutions. This fund of a quarter of a million dollars, given by an anonymous donor, has enabled over three hundred Pittsburgh teachers to attend summer sessions, and has been productive of excellent results making for greater efficiency in the schools.

The use of the kinetoscope as an educational agency is receiving attention in several quarters. New York City is to equip one hundred schools with machines, while Detroit plans to use these machines not only in the schoolroom, but also in outdoor evening entertainments at various playgrounds.

It is proposed during the coming year to make a thorough trial of the Courtis standard tests in arithmetic in the public schools of Detroit to determine the possibility of measuring scientifically the results of the teaching of arithmetic in the elementary schools.

Swarthmore College announces a complete reorganization of its department of psychology and education under the direction of Dr. Bird T. Baldwin, formerly head of the School of the Art of Teaching in the University of Texas. Courses will be given in general and educational psychology, school supervision, principles and practice of teaching and experimental education. Opportunities will be given for practice teaching in the public schools, and for special studies of industrial education and the education of defectives and delinquents.

An anonymous gift of $10,000 to the library of Oberlin College will be used, in part, to secure a complete collection of the recent publications on Eugenics.

Professor Karl Pearson recently delivered an address on the subject of "Eugenics and the Public Health" before the Congress of the Royal Sanitary Institute, held at York, England.

Dr. Clara Harrison Town of the Lincoln State School and Colony, Lincoln, Ill., has translated from the French Binet and Simon's little monograph, "A Method of Measuring the Development of the Intelligence of Young Children," which was published in the *Bulletin de la société libre pour l'étude psychologique de l'enfant*, April, 1911. This contains the revised form of the tests and the authors' directions for their application.

Professor Morton Prince, editor of the *Journal of Abnormal Psychology*, has retired from the chair of neurology in Tufts College Medical School, and has been made professor emeritus. He will be succeeded by Dr. J. J. Thomas, now assistant professor of neurology.

Dr. Henry H. Swain, for the past eleven years president of the Montana State Normal College, at Dillon, resigned at the close of the year, 1911-12.

Dr. C. A. Duniway, formerly president of the University of Montana, has been elected president of the University of Wyoming.

Dr. E. B. Craighead, president of Tulane University, of Louisiana, has accepted the presidency of the University of Montana.

Dr. Alexander Meiklejohn, professor of philosophy and dean of the faculty of Brown University, has been elected president of Amherst College.

Stephen S. Colvin, Ph.B. (Brown, '91), Ph.D. (Strasburg, '97), professor of psychology and director of the psychological laboratory in the University of Illinois, has accepted a chair in educational psychology in Brown University, newly established in co-operation with the State Board of Education, with the assistance of an appropriation made by the State Legislature.—*Science.*

Walter Fenno Dearborn, Ph.D. (Columbia), professor of educational psychology in the School of Education, University of Chicago, has been appointed assistant professor of education at Harvard University.

Harlan Updegraff, Ph.D. (Columbia), specialist in school administration, United States Bureau of Education, has been appointed professor of education and head of the department of education in Northwestern University.

Mrs. Mary Schenck Woolman, professor of domestic arts in Teachers College, Columbia University, has been elected president of the Women's Educational and Industrial Union.—*Science.*

L. R. Geissler, Ph.D. (Cornell), has resigned his position as research psychologist in the physical laboratory of the National Electric Lamp Association, Cleveland, to become professor of psychology at the University of Georgia. He will organize and direct the new psychological laboratory to be established in connection with the School of Education. The laboratory will occupy seven or eight rooms in George Peabody Hall, the new home of the School of Education now under construction, and will be furnished with all modern equipment.—*Science.*

Assistant Professor G. F. Arps, who has been acting head of the department of psychology of the University of Illinois during Professor Colvin's sabbatical year, has accepted a position in psychology in Ohio State University.

Lotus D. Coffman (Ph.D., Columbia, 1911) has been appointed to a professorship of education in the University of Illinois. During the past year Dr. Coffman served as lecturer in the School of Education, while still retaining the superintendency of the training department in the Eastern Illinois State Normal School.

Professor W. A. Jessup (Ph.D., Columbia, 1911) has been appointed dean of the School of Education at the University of Indiana.

Melvin E. Haggerty, Ph.D. (Harvard), assistant professor of psychology in the University of Indiana, has been advanced to an associate professorship in that institution.

Daniel Starch, Ph.D., instructor in psychology in the University of Wisconsin, has been made assistant professor of psychology.

Dr. Melbourne Stuart Read, professor of psychology in Colgate University, and secretary of the University, has been elected to the newly-established office of vice-president of the University.

Mr. William McDougall, F.R.S., well known for his contributions to physiological and social psychology, has been elected an extraordinary fellow of Corpus Christi College, Oxford.

George R. Wells, Ph.D. (Hopkins, '12), has been appointed instructor in psychology at Oberlin College.

Miss Ethel Andem has been appointed instructor in education at Wilson College.

Mr. Harry L. Miller, principal of the Kansas City High School, has been appointed to the principalship of the new model high school of the University of Wisconsin.

Mr. Gardner Cheney Bassett of Baltimore has been chosen university fellow in psychology in Johns Hopkins University.

William J. Hickson, M.D., has been appointed director of the division of medical research in the department of research of the New Jersey Training School for Feeble-Minded, at Vineland, N. J.

Mr. Edgar A. Doll (A.B., Cornell, 1912), who has lately served as assistant in psychology at the University of Wisconsin and as assistant in educational psychology at the summer session of Cornell University, has been appointed research assistant at the Vineland, N. J., Training School for Feeble-Minded Children, where he will devote his time to the investigation of special problems under the direction of Dr. H. H. Goddard.

Harry Miles Johnson, Ph.D. (Hopkins, '12), has been appointed psychological assistant in the physical laboratory of the National Electric Lamp Association, Cleveland, Ohio.

Principal Morgan of the training department of the Western State Normal School at Macomb, Ill., has been promoted to the presidency of the school, taking the position made vacant through the death of the late Alfred Bayliss.

Superintendent Frank B. Dyer of Cincinnati, Ohio, has been elected Superintendent of Schools in the City of Boston at a salary of $10,000 per year.

PUBLICATIONS RECEIVED TO JULY 1, 1912.

(Notice in this section does not preclude a more extended review.)

W. Betz. *Ueber Korrelation.* Leipzig: J. A. Barth, 1911. Pp. 88. M. 3.

A careful study of the nature of correlation, of the methods employed in its determination and of its significance for the measurement of mental capacity.

Edwin G. Cooley. *Vocational Education in Europe.* Report to the Chicago Commercial Club. Chicago: R. R. Donnelley & Sons Co., 1912. Pp. 347.

The greater part of this report is given over to a systematic account of industrial and vocational education in Germany. Two chapters are devoted to Austria and one to Switzerland. A final chapter embodies Dr. Cooley's recommendations regarding the direction of vocational education in America. These may be briefly summarized as follows: (1) The apprenticeship system should be revived and reorganized, but under the provision that the education of children between the ages of fourteen and eighteen should be distinctly provided for, and that those who employ children between these ages should assume part of the responsibility for such education. (2) The years six to fourteen "should be preserved for general cultural education." (3) The most important part of the education from fourteen to eighteen should be represented by vocational continuation schools demanding from six to ten hours' work each week, this to be "day" work, primarily technical in its nature, although not negligent of cultural aims. (4) Provision for vocational guidance is essential. (5) Vocational schools must be administered co-operatively by schoolmen and men from the vocations and trades. The report contains a large amount of valuable material, but unfortunately lacks an index.

June E. Downey. *The Imaginal Reaction to Poetry. The Affective and the Aesthetic Judgment.* Bulletin No. 2, Department of Psychology, University of Wyoming. 1912. Pp. 56.

Visual imagery exceeds any other type in every case. Indeed, visual images constitute almost half of the total images reported. In three cases the olfactory imagery played an important rôle, and in all cases the organic, kinaesthetic and optical-kinaesthetic images were fairly frequent, and added much to the vividness of the affective reaction. In many cases there was a decided difference between the

affective judgment "pleasing" and the aesthetic judgment "beautiful." The basis of the latter seemed to be more intelligent and reflective than the former, and consisted largely of the recognition of skill in verbal manipulation.

SAMUEL CHANDLER EARLE. *The Theory and Practice of Technical Writing.* New York: The Macmillan Company, 1911. Pp. vii, 301. $1.25 net.

An interesting compendium on style for engineers and others who have occasion to express themselves on technical subjects. Part I deals with the general principles of logical structure, and Part II discusses the practical application of these principles to the problems of the technician. Throughout the book there are copious examples drawn from technical literature. Anyone who has had much experience with the manuscripts of scientific men will appreciate the need for such a course in technical writing, and the present textbook seems to meet the requirements admirably.

GUY G. FERNALD. *The Defective Delinquent Class: Differentiating Tests.* Reprinted from the American Journal of Insanity, 68: No. 4, April, 1912. Pp. 523-594.

A very interesting study of the mental abilities of criminals. The tests included weight discrimination, extent of movement, color, vision, rate of tapping, speed and accuracy of movement, achievement capacity test, cancellation test, calculation test (counting backward by three from 31), uncontrolled association test, recognition memory test, ethical perception and ethical discrimination. One hundred subjects were tested, and on the basis of the results were ranked in an ascending scale of efficiency. The detailed clinical notes on the subjects were arranged in the same order, so that comparisons may be easily made. Comparison with the normal performance in each test shows that twenty-six of the subjects were decidedly defective, and another twenty-six were subnormal. Only forty-eight of the one hundred subjects could be called mentally normal. This is perhaps the most valuable psychological study of criminals that has yet been made.

ARNOLD L. AND BEATRICE CHANDLER GESELL. *The Normal Child and Primary Education.* Boston: Ginn & Co., 1912. Pp. x, 342. $1.25.

A very desirable discussion, from the biological point of view, of some of the problems of elementary education. Parts I and II present the historical introduction and the genetic background, Part III outlines the pedagogy of the primary school as it ought to be rather than it is, and Part IV deals with the conservation of child life. A valuable appendix contains a trenchant criticism of the Montessori methods.

BERNARD HART AND C. SPEARMAN. *General Ability; Its Existence and Nature.* Reprinted from the Journal of Psychology, 5: March, 1912, 51-79.

Every intellectual performance depends on a "General Factor," and also in varying degree on a factor specific to itself and all very similar performances. Or, put physiologically, "every intellectual act appears to involve both the specific activity of a particular system of cortical neurons and also the general energy of the whole cortex." This general factor, in the belief of the authors, explains the correlation between different intellectual performances as to the nature and degree of which so much controversy has arisen in the recent literature of mental tests.

CHRISTIAN A. HERTER. *Biological Aspects of Human Problems.* New York: The Macmillan Company, 1911. Pp. xvi, 344. $1.50 net.

More and more the biological point of view is pervading all departments of human thought. To an ever-increasing degree psychology, sociology, ethics, and even religion, are feeling its influence, while it is rapidly working a revolution in the whole scheme of educational procedure. As yet, however, the popular view of life problems, always conservative, has been but little affected by biological thinking. The present interesting and important volume considers some of the fundamental problems of human society in the light of the two great biological tendencies, self-preservation and the preservation of the species through the sex relationship. Some of the topics considered are health and disease, mental health, personality and the belief in immortality, the problem of the will, moral responsibility and education, marriage and divorce in relation to the family, art and religion, the position of women and the future of the race. The book is readable, makes a popular appeal, and should be read by every serious-minded student of human relations.

C. EDWARD JONES. *Sources of Interest in High School English.* New York: The American Book Co., 1912. Pp. 144. $0.80.

A report on the results of a questionnaire sent to the high school teachers and pupils of seven cities, inquiring what reading was done during the past year, what was particularly liked in each case, and why. The 4000 results are tabulated by years of the high school course, by cities, and by sexes. Plot is the strongest element of interest in high school reading, with character and moral second. Style has slight influence (4 per cent.) in the first year, but rises steadily to 20 per cent. in the last. In a lesser degree the same is true of description. There is no evidence that girls' reading differs in quality from that of boys'.

J. D. Lickley. *The Nervous System. An Elementary Handbook of Its Anatomy and Psysiology for the Use of Students of Psychology and Neurology.* New York: Longmans, Green & Co., 1912. Pp. xii, 130. $1.80 net.

In ten chapters the author discusses the animal cell, nerve cells and fibres, the general structure and development of the nervous system, the spinal cord, the hind-brain, mid-brain and fore-brain, the chief fibre systems of the cerebro-spinal axis, areas of localization in the cortex and the structure of the sense organs. The 118 illustrations and diagrams are large and clear, and many of them are printed in color, greatly facilitating the recognition of the parts. There is a good index.

E. B. Lowry, M.D. *False Modesty.* Chicago: Forbes & Co., 1912. Pp. 110.

Publication in book form of eight magazine articles that aim to show fathers and mothers "the necessity of early and proper instruction for both boys and girls in matters pertaining to sex, and to prove that the parents who withhold this knowledge are committing a crime in allowing their children to fall because of ignorance." The excellence of Miss Lowry's other books on sex hygiene will insure a ready hearing for this little volume.

James Phinney Munroe. *New Demands in Education.* New York: Doubleday, Page & Co., 1912. Pp. x, 312. $1.25 net.

The most important of these demands are (1) for small classes, so that the teacher may really know each one of her pupils; (2) greater consideration for the health of the child; (3) interesting and stimulating work in the schools; (4) the training of all the pupil's senses; (5) emphasis upon character; (6) preparation for effective living in the social community; (7) advisors for pupils after they leave school; (8) wide variety of educational opportunity after pupils leave school. While the book abounds in platitudes and gives little evidence of close thinking (its psychology is particularly archaic), the author is evidently in earnest, and his appeals point in the right direction.

William Starr Myers. *Country Schools for City Boys.* Bulletin 480. Washington: Bureau of Education, 1912. Pp. 22.

A description of the school life and work in several prominent private schools for boys.

Ossip-Lourié. *Le langage et la verbomanie.* Paris: F. Alcan, 1912. Pp. 275. 5 fr.

The author of this curious and typically French book considers talkativeness a psycho-social disease, and arraigns present domestic, educational and social practices as tending to spread the contagion

rather than to check it. He advocates accustoming children to be alone with their thoughts, and urges the organization of "leagues of silence," the object of which shall be to provide places of social meeting to counteract the present tendency to talk much and say little. The book contains many shrewd observations on the relation between thought and language.

WILHELM OSTWALD. *Monistische Sonntagspredigten.* Zweite Reihe. Leipzig: Akademische Verlagsgesellschaft, 1912. Pp. 209-416.

In this second series of Sunday sermons Ostwald considers such varied topics as freedom of the will, morals and science, the training of children, art, politics and language. Hereafter the sermons will appear in the new fortnightly organ of the German Monistic Society, *Das Monistische Jahrhundert,* published by E. Reinhardt, Jägerstr. 17, München.

G. E. PARTRIDGE. *The Genetic Philosophy of Education. An Epitome of the Published Writings of President G. Stanley Hall of Clark University.* New York: Sturgis & Walton Company, 1912. Pp. xvii, 401. $1.50 net.

This simple, straightforward presentation of President Hall's views on educational questions, bearing as it does the stamp of President Hall's approval, will be warmly welcomed by students of education who desire to find out quickly and in brief compass the essence of those views without the inconvenience of searching through widely-scattered publications.

W. P. REAVES. *The Conservation of the Health, Teeth, Voice, Hearing and Sight.* Greensboro, N. C.: Privately printed for the author, 1912. Pp. 35.

Two lectures of the "popular" type, with illustrations from which slides may be prepared, and full directions for delivering the lectures, and suggestions for the detection of sensory defects by parents and teachers.

A Report on Vocational Training in Chicago and in Other Cities. Chicago: Published by the City Club of Chicago, 315 Plymouth Court, 1912. Pp. xiii, 315. $1.50.

This excellent report presents one of the best surveys of the present status of vocational education that is obtainable. The needs and existing provisions for industrial and commercial training in Chicago are set forth and compared with those prevailing in twenty-nine other cities. Among the recommendations made are two-year elementary vocational schools, elementary industrial schools for over-age children below grade seven, trade schools for boys and girls, apprentice schools, co-operation with employers to secure day continuation

schools, legislation to raise the compulsory age limit, co-operative courses in the high school and industrial courses for girls in the high school.

J. ROGUES DE FURSAC, M.D. *Manual of Psychiatry.* Translated and edited by A. J. ROSANOFF, M.D. New York: John Wiley & Sons, 1911. Pp. xvi, 484. $2.50 net.

Dr. Rosanoff translated the first edition of this well-known manual in 1905; the second edition in 1908. The present volume is a third edition from the third French edition. It gives the best statement in English of the classification of insanity developed by Kraepelin. The third edition adds a brief presentation of some of the newer views in psychiatry. Thus the author has added sections on disorders of writing, criteria of prognosis in dementia praecox, chronic mania and acute mental attacks in the feeble-minded, while the translator has added sections on the Binet-Simon scale, the influence of parental alcoholism, psycho-therapy, Mendelism and the inheritance of insanity, and numerous other topics. We recommend the book to those who desire a compact, authoritative and up-to-date survey of the field of insanity.

M. C. SCHUYTEN. *Korte Inleiding tot de Paedologie* (Brief Introduction to Paidology.) Antwerp: Victor Resseler, 1912. Pp. 25.

A chronological sketch of the development of paidological investigation from 1765 to 1910.

M. C. SCHUYTEN. *La Pédologie.* Gand: I. Vanderpoorten, 1911. Pp. 229.

The peculiar excellence of this book lies in the fullness of the bibliography and its arrangement. The subject is treated in ten sections, or books, each of which contains from one to twelve chapters. Each chapter is headed by a fairly complete bibliography of the topic, and the discussion is scarcely more than a brief comment upon the general trend of the literature. In all, 2882 publications are thus listed. The sections are entitled school hygiene, anthropometry, physiology, normal psychology, abnormal psychology, animal psychology, normal pedagogy, abnormal pedagogy, social problems, and anthropology and the history of the child.

ROMIETT STEVENS. *The Question As a Measure of Efficiency in Instruction. A Critical Study of Classroom Practice.* New York: Teachers College, Columbia University, 1912. Pp. 95.

Of all the means available to the teacher for stimulating and directing the activities of pupils, the most important is undoubtedly the question. It behooves each teacher, therefore, to devote careful study to the subject of questioning, to determine when to question,

how to question and what effect a given question will probably have upon the thinking of the pupil. Even the best teachers pay all too little attention to their questioning at present, and tend to swamp the thought of the class with questions. Out of one hundred random observations, twenty-eight showed between one hundred and two hundred questions asked by the teacher in a forty-minute period. Obviously, when questions come at the rate of three to five per minute, pupils have no time to think. Every teacher should read and ponder over the report of this investigation.

CALVIN THOMAS. *A Practical German Grammar.* Fourth Edition. New York: Henry Holt & Co. Pp. x, 485.

The book is divided into two parts, of which Part I is a beginners' manual, and Part II presents the details of formal grammar. The author believes that all learners should have grammar from the first. Great care has been taken in the selection of exercises, with a view to the development of a sensitive and trustworthy "feeling" for the language. A feature of Part I is the abundant use of English cognates in the vocabularies.

J. E. WALLACE WALLIN. *Experimental Oral Euthenics. An Attempt Objectively to Measure the Relation Between Community Mouth Hygiene and the Intellectual Efficiency and Educational Progress of Elementary School Children.* Reprinted from Dental Cosmos, April and May, 1912. Pp. 32.

One of the most important studies ever made in connection with the subject of dental hygiene.

J. E. WALLACE WALLIN. *Present Status of the Binet-Simon Graded Tests of Intelligence.* Reprinted from Alienist and Neurologist, 33: No. 2, May, 1912. Pp. 14.

On the basis of extended studies upon epileptics, the author is convinced that the Binet tests form a very serviceable measuring scale for the grading and classification of defectives. He expresses some doubt, however, whether the 1911 revision is an improvement over the 1908 form. One of the chief problems for future investigation is the establishment of normal norms of variation for the different ages.

JOHN H. WALSH. *Practical Methods in Arithmetic.* New York: D. C. Heath & Co., 1911. Pp. iv, 395. $1.25.

Emphasis is laid upon drill in the art of manipulating numbers rather than upon explanations of the reasons underlying different processes.

WEBSTER WELLS AND WALTER W. HART. *First Year Algebra.* New York: D. C. Heath & Co., 1912. Pp. vi, 325. $0.90.

E. C. Wesselhoeft. *An Elementary German Grammar.* New York: D. C. Heath & Co., 1912. Pp. xvi, 272. $0.90.

The chief aim of the author is to present the essentials of grammar as clearly and concisely as possible. The exercises are abundant and well chosen to afford drill on essentials, particularly the forms of the verb, and in them the simple style of every-day speech is preserved throughout.

William Cecil Dampier Whetham and Catherine Durning Whetham. *Heredity and Society.* New York: Longmans, Green & Co., 1912. Pp. viii, 190. $2 net.

By the authors of *The Family and the Nation*, and written with a similar purpose—to draw attention to the problem of heredity and its relation to sociology. The fundamental thesis is the one that Pearson and many other writers are defending so emphatically, that better educational facilities and better environmental conditions in general will not suffice to advance the fundamental traits and qualities of a nation. Selection is essential for this. The volume, therefore, adds one more to the increasing number of treatises on eugenics.

Arthur Wreschner. *Die Sprache des Kindes.* Zürich: Orell Füssli, 1912. Pp. 43. 80 Pf.

A compact discussion of the development of linguistic activities in the child. The reciprocal influence upon each other of language and thought, the chief stages of word and sentence building and the gradual crystallization of meaning are salient features of the monograph.

Arthur Wreschner. *Vergleichende Psychologie der Geschlechter.* Zürich: Orell Füssli, 1912. Pp. 40. 80 Pf.

A survey of sex differences in sensitivity, discrimination, speed and accuracy of movement, various aspects of memory and association, character of imagery, verbal expression, the psychology of report and a discussion of the bearing of these on co-education.

Emily Dudley Wright. *The Psychology of Christ.* New York: Cochrane Publishing Co., 1909. Pp. 106.

A quasi-mystic, sentimental and religious discussion by a Froebelian of will, conscience, wisdom, soul, spirit and similar topics. The reader might get some religious inspiration, but would find it difficult to detect any modern psychology.

Emily Dudley Wright. *The Child in Our Midst.* New York: Cochrane Publishing Co., 1909. Pp. 22.

A booklet similar in type to the author's *Psychology of Christ.*